
bushfire responsive architecture

Bushfire Responsive Architecture

Aim:
Reconciliation of (the otherwise) opposing management goals of biodiversity conservation and bushfire safety.

Approach:
Through holistic design (landscape with architecture) unify these two objectives within daily life.

Dr Ian Weir

Research Architect (Bushfire)

Head of Landscape Architecture

Queensland University of Technology

Experience:

- Registered practicing architect (WA)
- Photographic Artist
- Industrial Designer
- Land surveyor

Bushfire Research

- Adviser to Kelvin Thompson, Vic MP for Black Saturday Royal Commission
- Adviser to survivors of Black Saturday
- Invited appearances on ABC New Inventors, SBS Insight
- Invited exhibitor 2012 Venice Architecture Biennale

Heath House 2007

Bushfire Responsive Architecture

Reconciling bushfire safety and biodiversity conservation with daily life

QUT

ABC

Karri House

Bushfire Responsive Architecture (BAL40)

Reconciling bushfire safety and biodiversity conservation with daily life

How to reconcile the (otherwise) opposing management goals of bushfire safety and biodiversity conservation.

Why bushfires aren't responsible for house losses

Why passive risk management through design is safer than active vegetation management.

How it can be cheaper and safer to build to the higher Bushfire Attack Levels of AS3959 – rather than lower levels

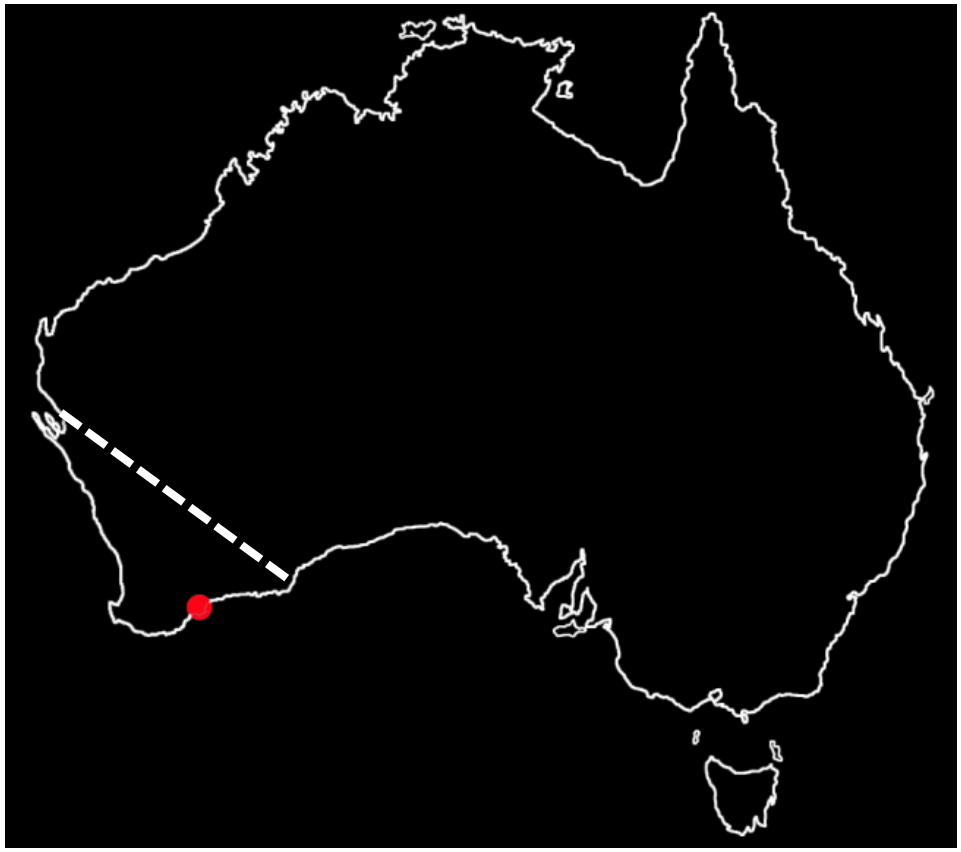
What is the role of art and architecture

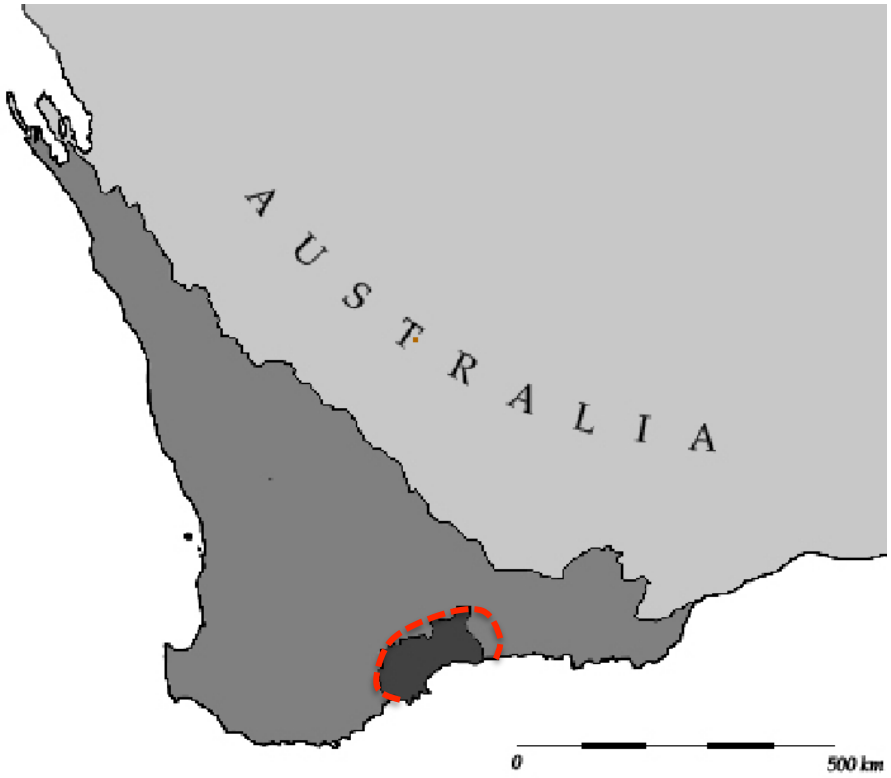

backstory

CONTENT

Backstory

Content 1960’s





Southwest Botanical Province

Conservation International Biodiversity Hotspot


UNESCO
Fitzgerald Biosphere Region

CONTENT

Heath House 2007

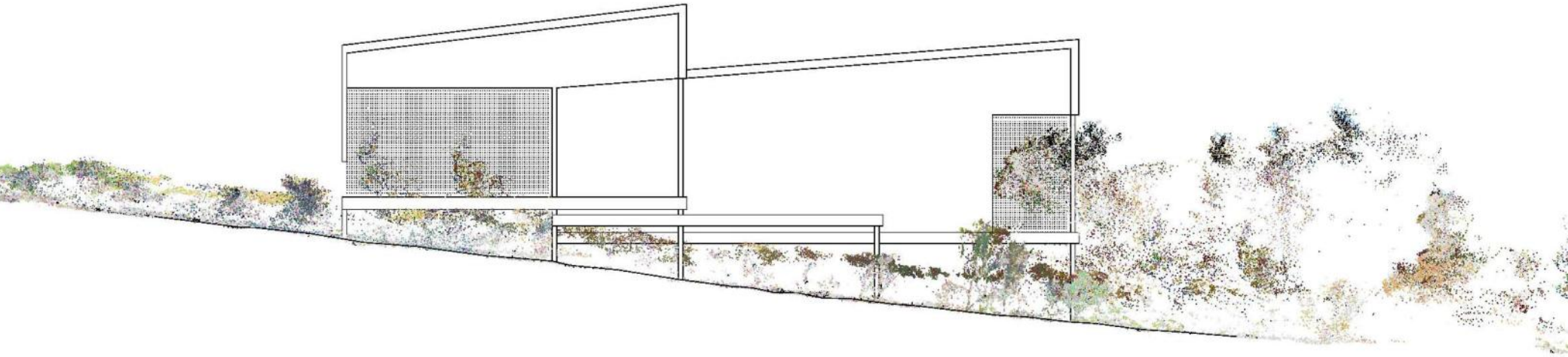
Bushfire Responsive Architecture

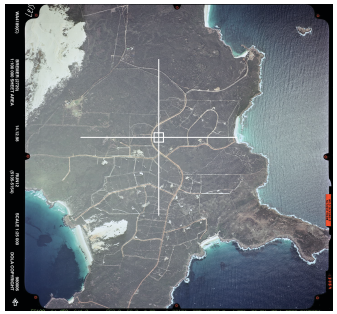
Reconciling bushfire safety and biodiversity conservation with daily life

Heath House 2007

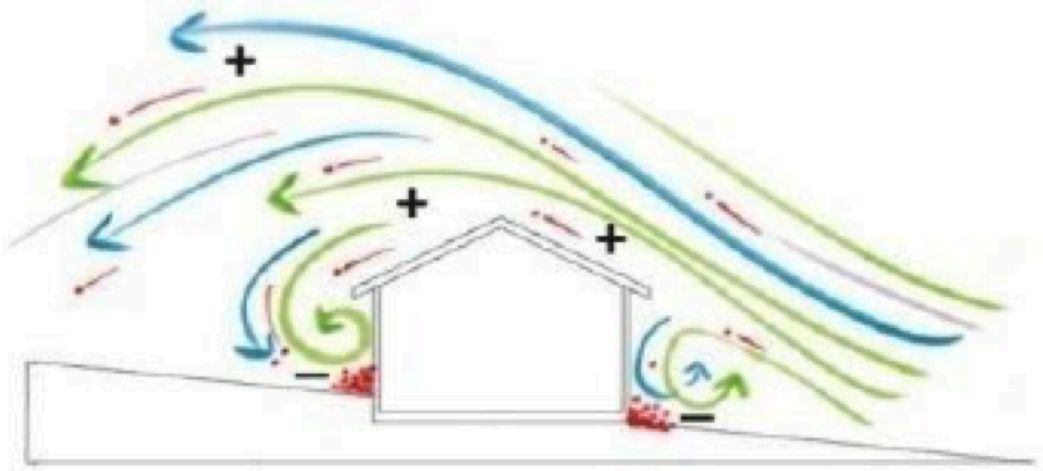
Bushfire Responsive Architecture

Reconciling bushfire safety and biodiversity conservation with daily life



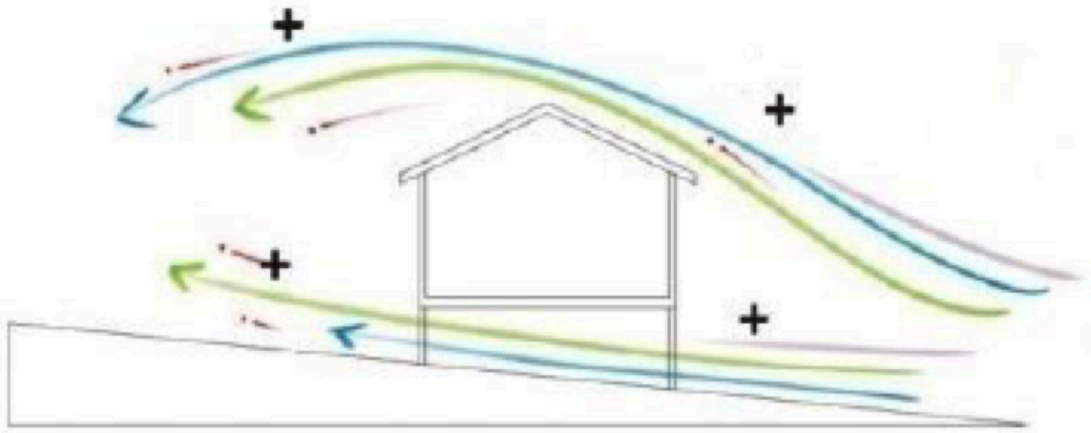


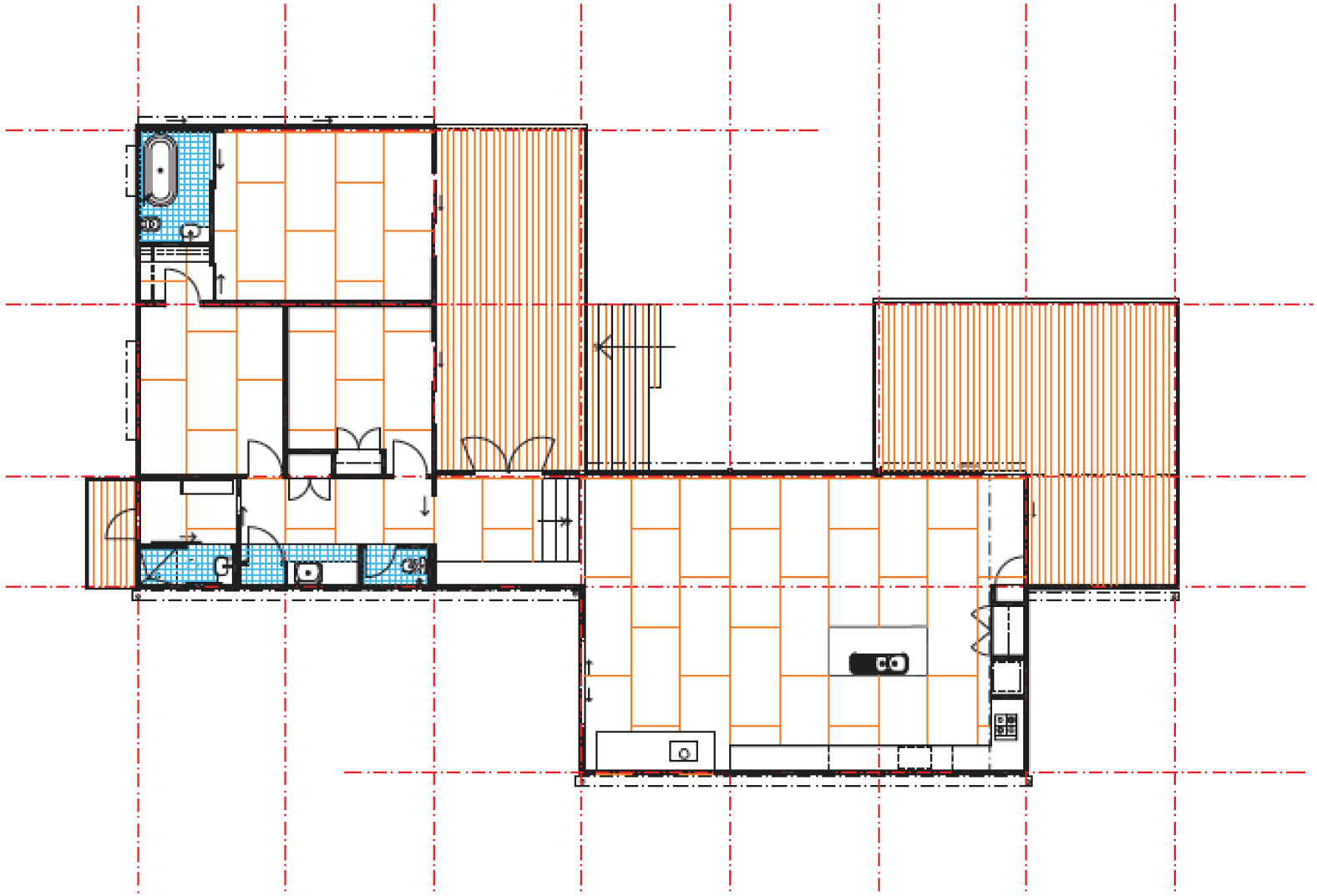
Hollingworth House

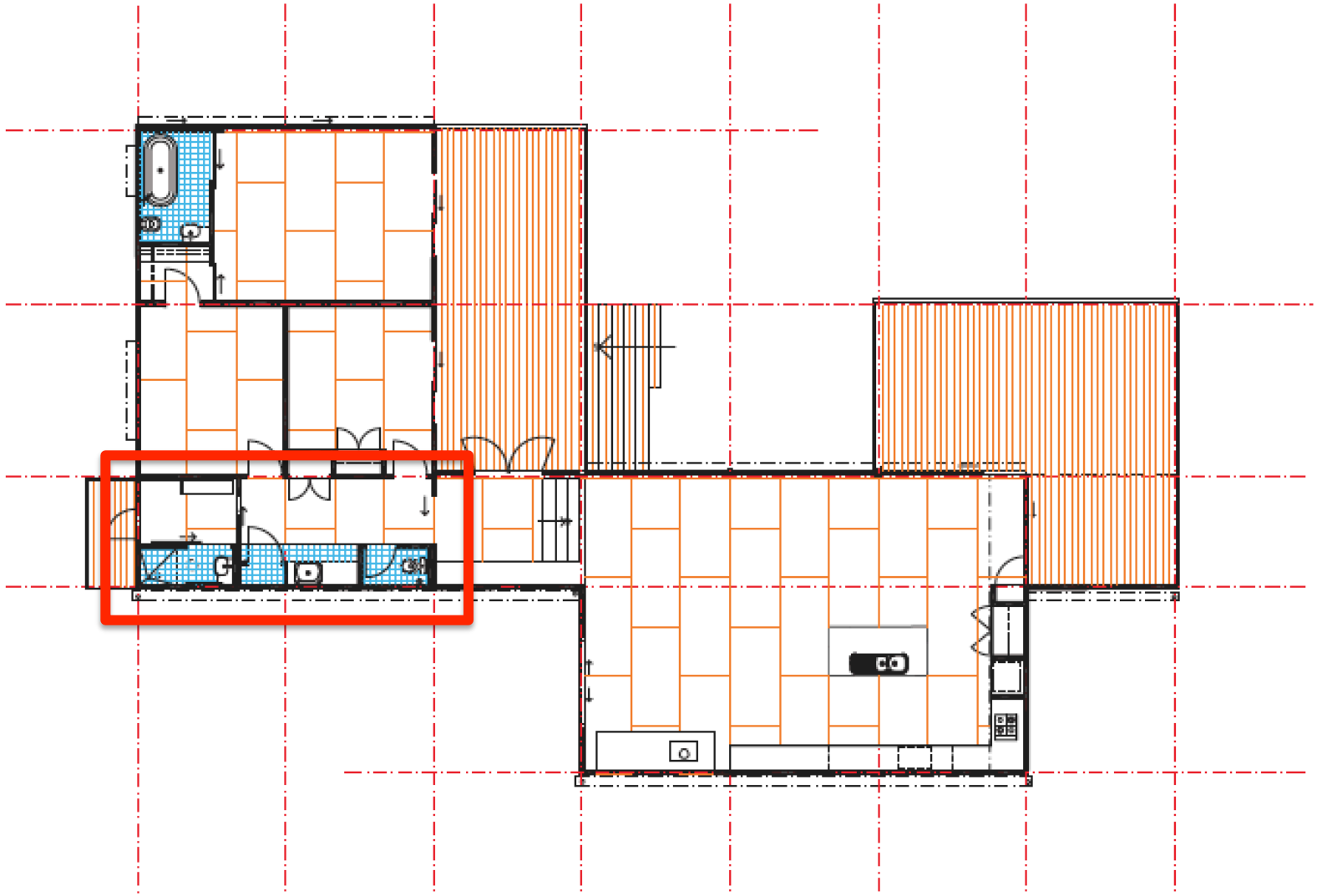


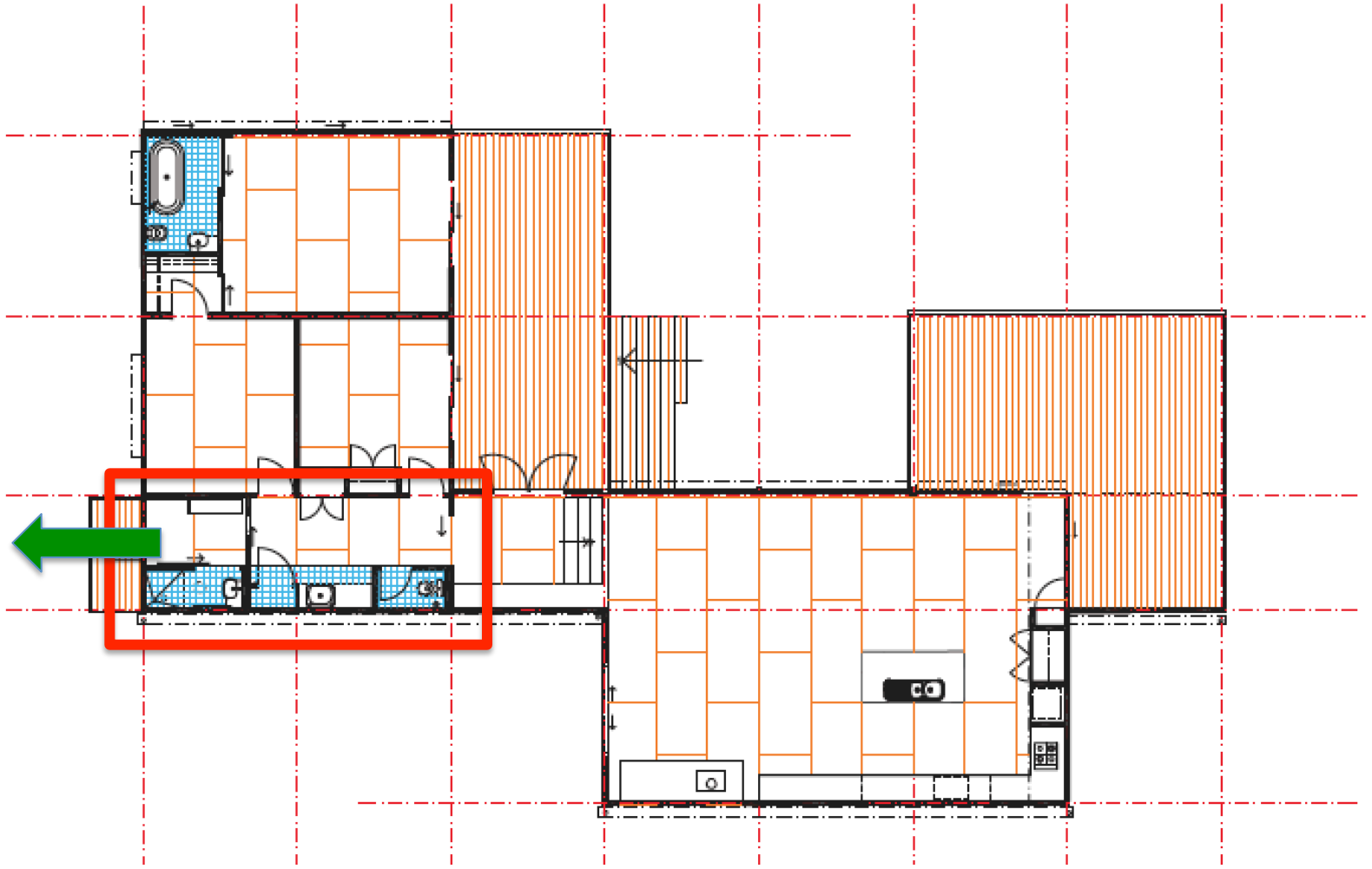
LEARNING FROM CYCLONES

Above: eposition of embers at perimeter of house due to positive/negative pressure difference, this is reduced by elevating the house as below. We can forget about the extremely high winds and pressures differentials houses experience in bushfires



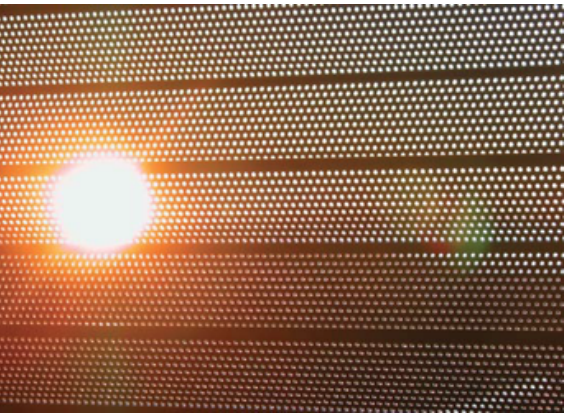






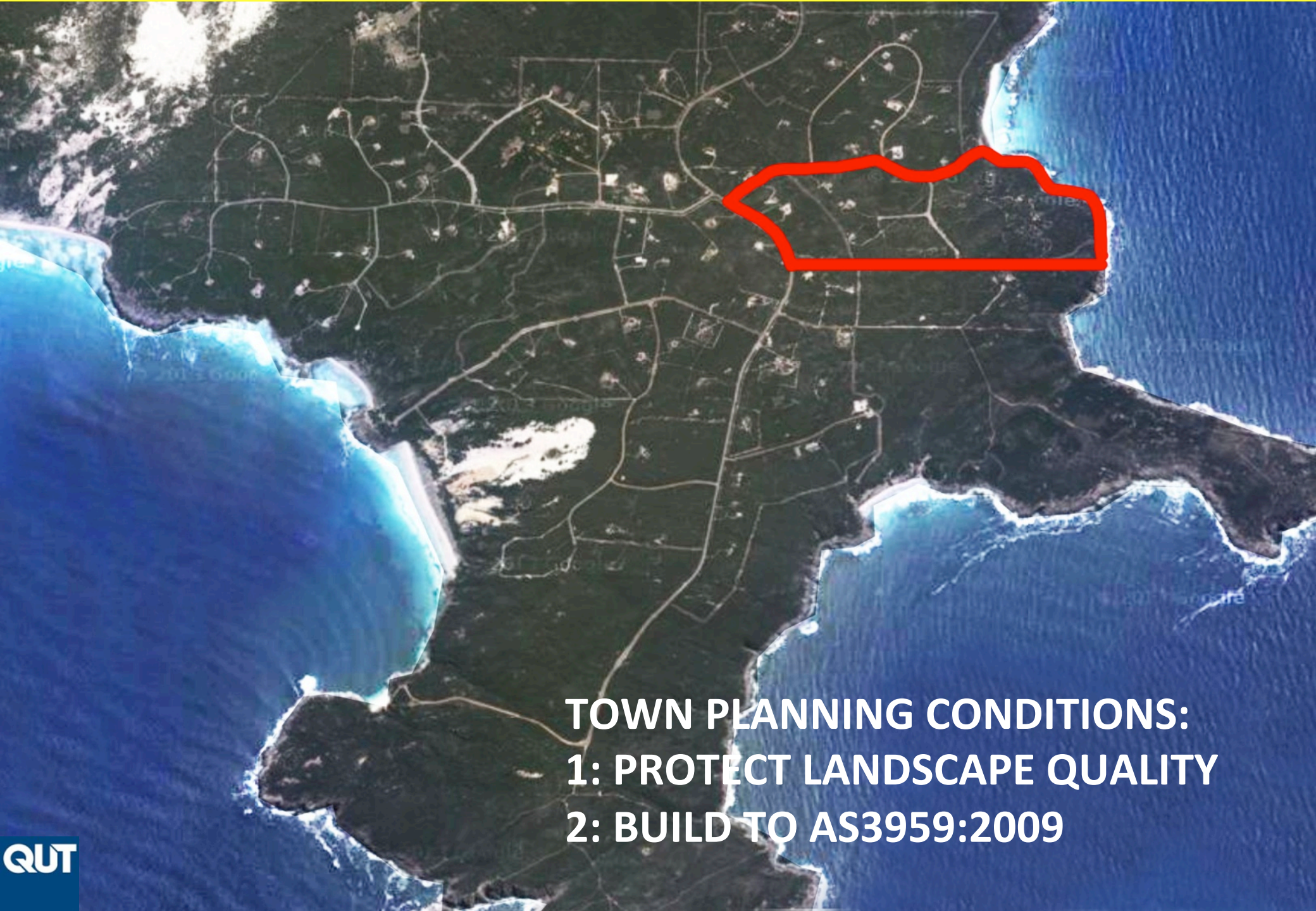
TIME LAG:

Escape into a burnt landscape – even if the house is on fire



ABC

Reconciling bushfire safety and biodiversity conservation with daily life


TOWN PLANNING CONDITIONS:
1: PROTECT LANDSCAPE QUALITY
2: BUILD TO AS3959:2009


Short Beach Rd

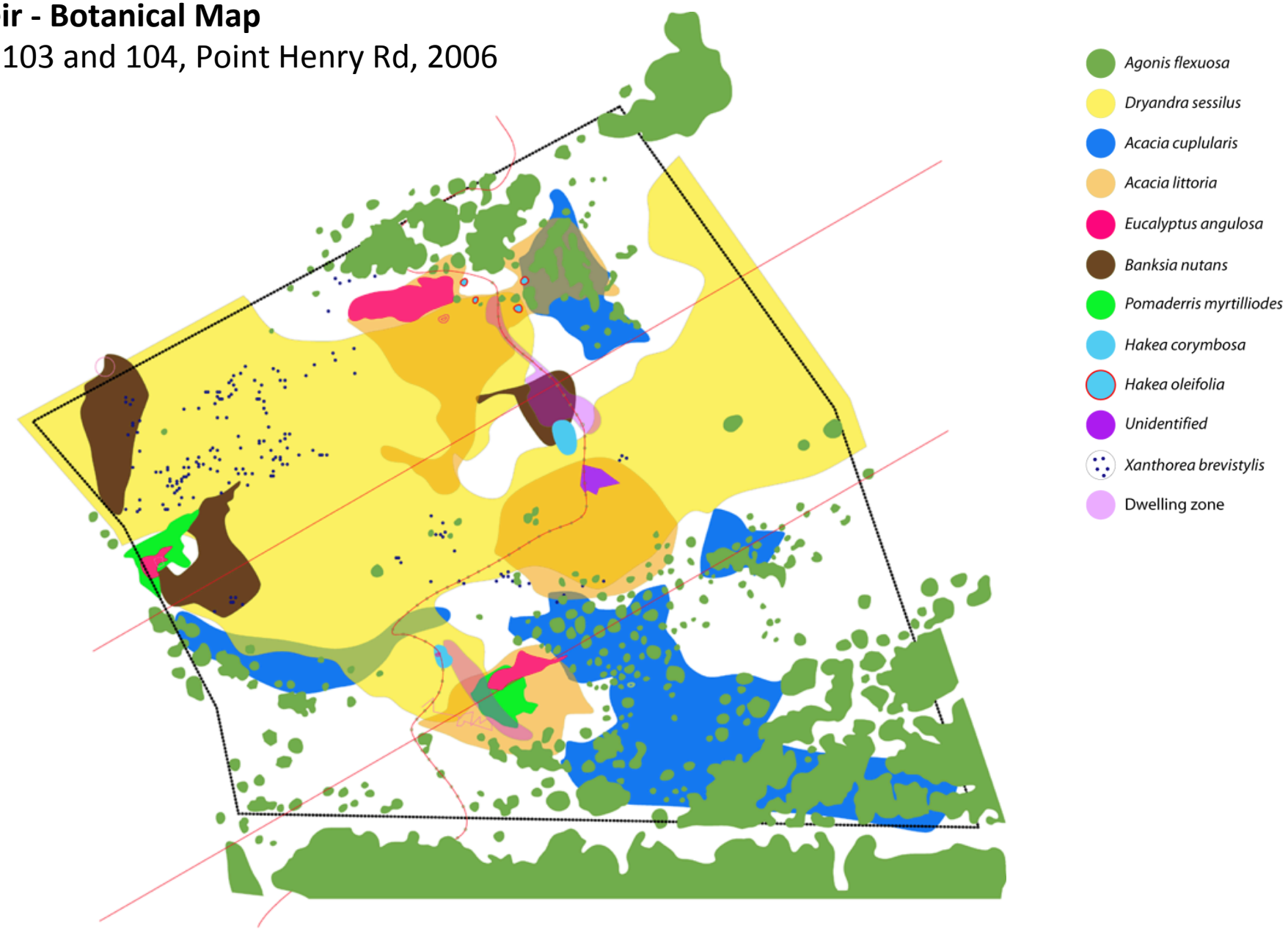

Lot 103
'CONTENT TOO'

LOT 103

CONTENT TOO

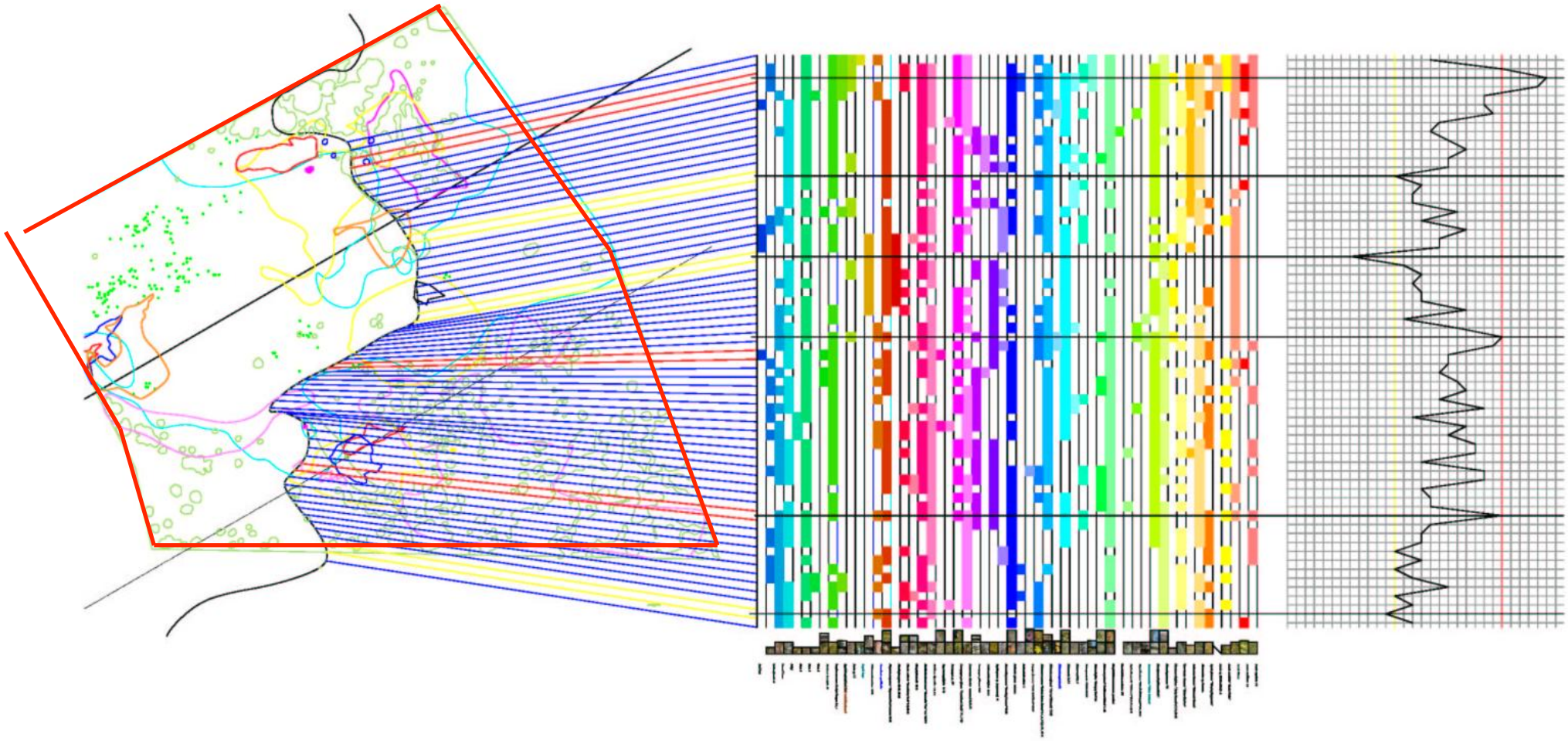
I Weir - Botanical Map

Lots 103 and 104, Point Henry Rd, 2006



Barb Miller-Hornsey/I Weir Botanical Map

Lots 103 and 104, Point Henry Rd, 2006

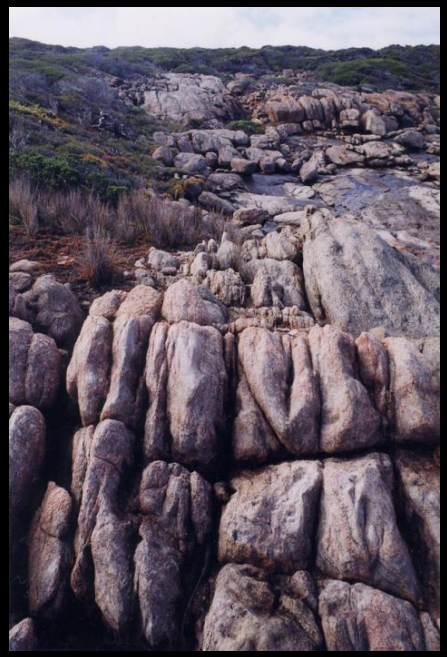


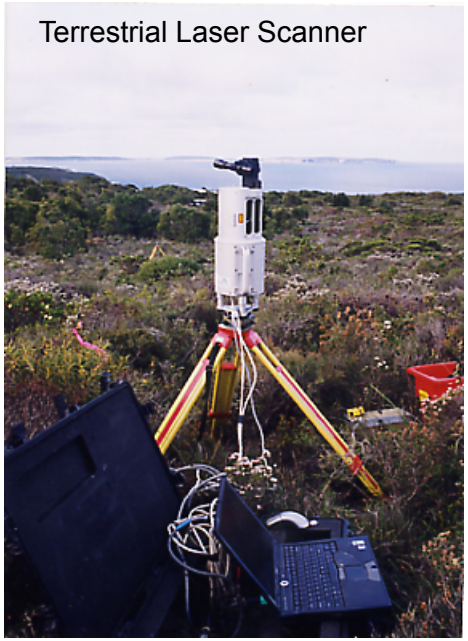
Barb Miller-Hornsey's Botanical Survey

Lots 103 and 104, Point Henry Rd, 2006

109 Botanical Species

Acacia cochlearis
Acacia littorea
Acacia myrtifolia "Myrtle Wattle"
Acacia sp. (Unidentified)
Agonis flexuosa "Weeping Peppermint"
Alocasuarina sp. Common
Anthocereis littorea "Yellow-tail Flower"
Asparagus asparagnoides "Bridal Creeper"
Banksia nutans
Bossaeia praetermissa
Burnettia nigricans "Potato Orchid"
Caladenia bicalliata "Limestone Spider Orchid"
Caladenia cairnsiana "Zebra Orchid"
Caladenia flava "Cowslip Orchid"
Caladenia latifolia "Pink Fairy Orchid"
Caladenia longicauda, subsp. australora "Southern White Spider Orchid"
Carpobrotus virescens "Native Pig Face"
Chamaescilla corymbose
Chorizema ilicifolium "Holly Flame Pea"
Clematis 2
Clematis pubescens
Comesperma confertum
Comesperma polygaloides
Cyanicula gemmata "Blue China Orchid"
Dianella revolute
Drandra sessilis "Parrott Bush"
Drosera macrantha "White Rainbow"
Dryandra nivea "Crouched Honey-pot"
Elythranthera brunonis "Purple Enamel Orchid"
Eriochilus dilitatus, subsp. Magnus "Baby Bunny Orchid"
Eucalyptus angulosa "Ridge-fruited Mallee"
Euphorbia paralis "Milkweed" (Introduced)
Gompholobium confertum
Gompholobium tomentosum prevalent
Ground Cover (Unidenfied)
Ground Cover 1
Hakea corymbosa "Cauliflower Hakea"
Hakea oleifolia "Mungup Tree"
Hakea prostrata "Harsh Hakea"
Hakea ruscifolia 3
Hakea varia
Hibbertia amplexicaulis
Hibbertia cuneiformis "Cut-leaf Hibbertia"
Hibbertia racemosa "Stalked Guinea Flower"
Homalosciadium homalocarpum
Isopogon formosus "Rose Coneflower"
Isotropis cunefolia "Lamb Poison"
Jacksonia furcellata 3
Jacksonia spinosa common
Kennedia nigricans "Black Kennedia"
Kennedia nigricans "Black Kennedia"
Kennedia prostrata "Running Postman"
Lagenifera stiptata
Lepidosperma sp. (angustatum)
Leptoceras menziesii "Rabbit Orchid"
Leschenaultia tubiflora
Leucipogon parviflorus "Coast Beard Heath"
Leucopogon gibbosus
Leucopogon obovatus common
Leucopogon sp.
Linum marginale "Native Flax"
Logania serpyllifolia
Lysinema ciliatum
Melaleuca thymoides
Melaleuca thymoides
Meuhlenbeckia adpressa "Sarsparilla Vine"
Microtis brownii "Sweet Mignonette Orchid"
Microtis media "Common Mignonette Orchid"
Moss
Olax phyllantanthi
Olearia axillaris "Coast Daisy Bush"
Olearia ciliata "Fringed Daisy Bush"
Onopordum acanthium "Scotch Thistle" (Introduced)
Opercularia ?hispidula
Patersonia ocidentalis
Pelargonium littorale
Phyllanthus calycinus "False Boronia"
Pimelea sp. (P. drummondii)
Pimelia ferruginea
Platysace compressa "Tapeworm Plant"
Podetheca angustifolia "Sticky hang-heads"
Podetheca gnaphalioides "Golden Long-heads"
Pomaderris myrtilliodes
Prasophyllum fimbria "Fringed Leek Orchid"
Prasophyllum sp. (P. triangulare)
Pultenaea obcordatum
Pultenaea obcordatum
Pultenea tenuifolia
Regelia inops
Restio sp.
Scaevola crassifolia "Thick-leafed Fan-flower"
Sedge 1
Sedge 2
Senecio lautus, subsp. dissectifolius
Solanum laciniatum "Kangaroo Apple"
Sphaerolobium vimineum "Leafless Globe Pea"
Spheralobium vimineum
Spyridium globulosum
Stylidium adnatum "Common Bearded Trigger Plant"
Templetonia retusa Cocky's Tongues
Thysanotis multiflorus
Thysanous patersonii "Climbing Fringed Lilly"
Unidentified red plant
Waitzia accuminata "Golden Waitzia"
Waitzia sauveolens "fragrant Waitzia"
Wheat grass 1
Wheat grass 2
Wheatgrass 3
Xanthorea brevstylis





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14,	719373.952,	6185981.950,	78.354,	PRL
15,	719467.292,	6185848.459,	76.593,	PRL
16,	719320.374,	6185724.118,	82.786,	PRL-
17,	719312.725,	6185775.220,	84.307,	PRL
18,	719240.943,	6185761.361,	86.722,	PRL
19,	719189.207,	6185742.161,	89.139,	PRL
20,	719161.558,	6185795.782,	93.054,	PRL
21,	719122.294,	6185840.269,	96.863,	PRL
22,	719009.815,	6185936.008,	99.586,	PRL
23,	719160.908,	6185983.067,	96.253,	PRL
24,	719204.026,	6185955.075,	94.524,	PRL
25,	719208.421,	6185997.998,	90.935,	PRL
26,	719208.415,	6185997.995,	90.937,	PRL
27,	719263.600,	6185850.478,	88.901,	PRL
28,	719243.713,	6185884.490,	89.121,	PRL
29,	719245.691,	6185887.717,	88.287,	PRL
30,	719249.635,	6185889.307,	87.598,	PRL
31,	719253.168,	6185891.461,	87.006,	PRL
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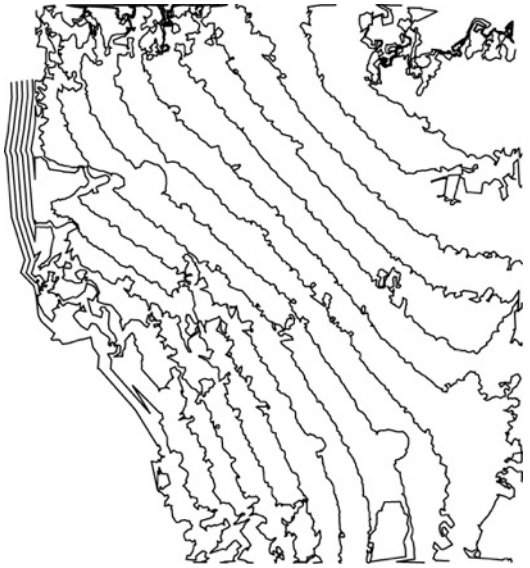
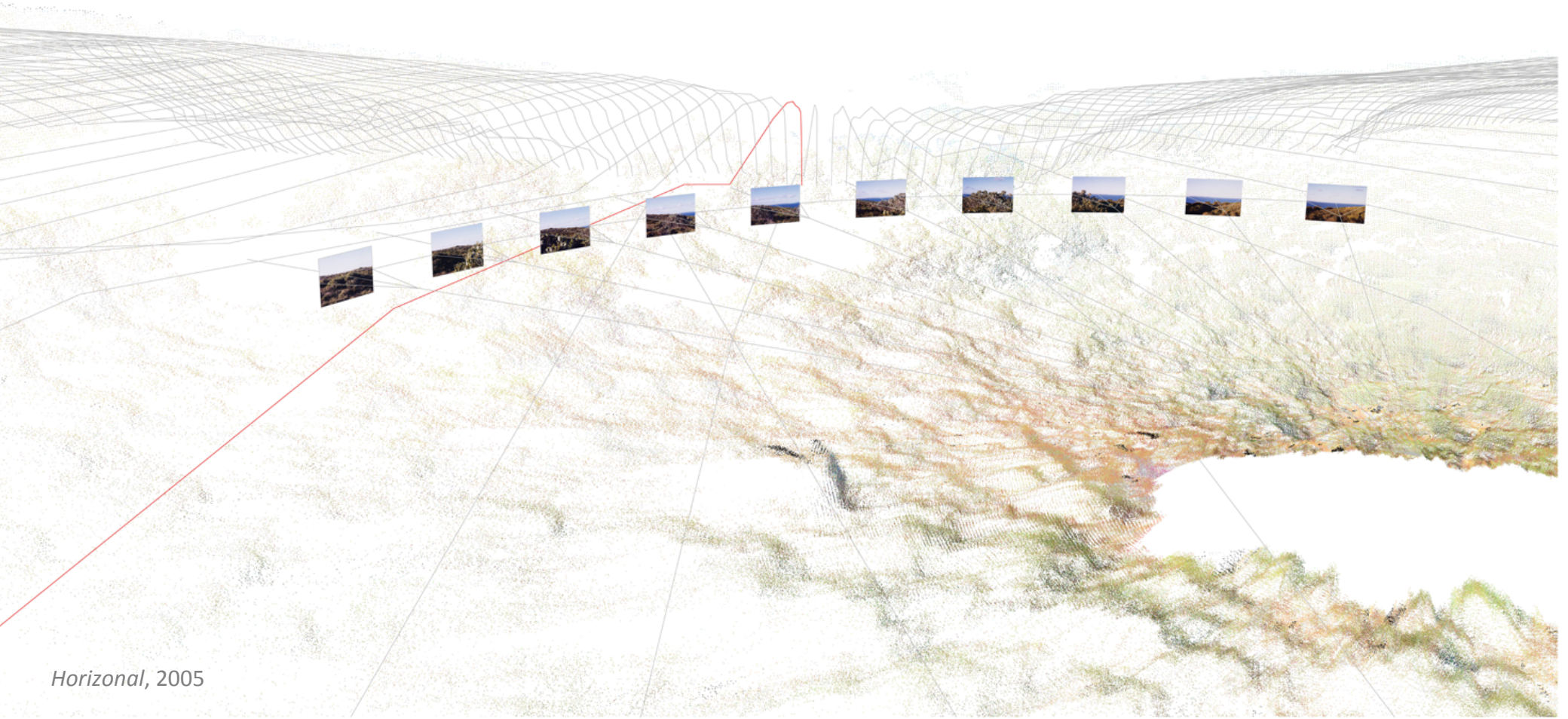
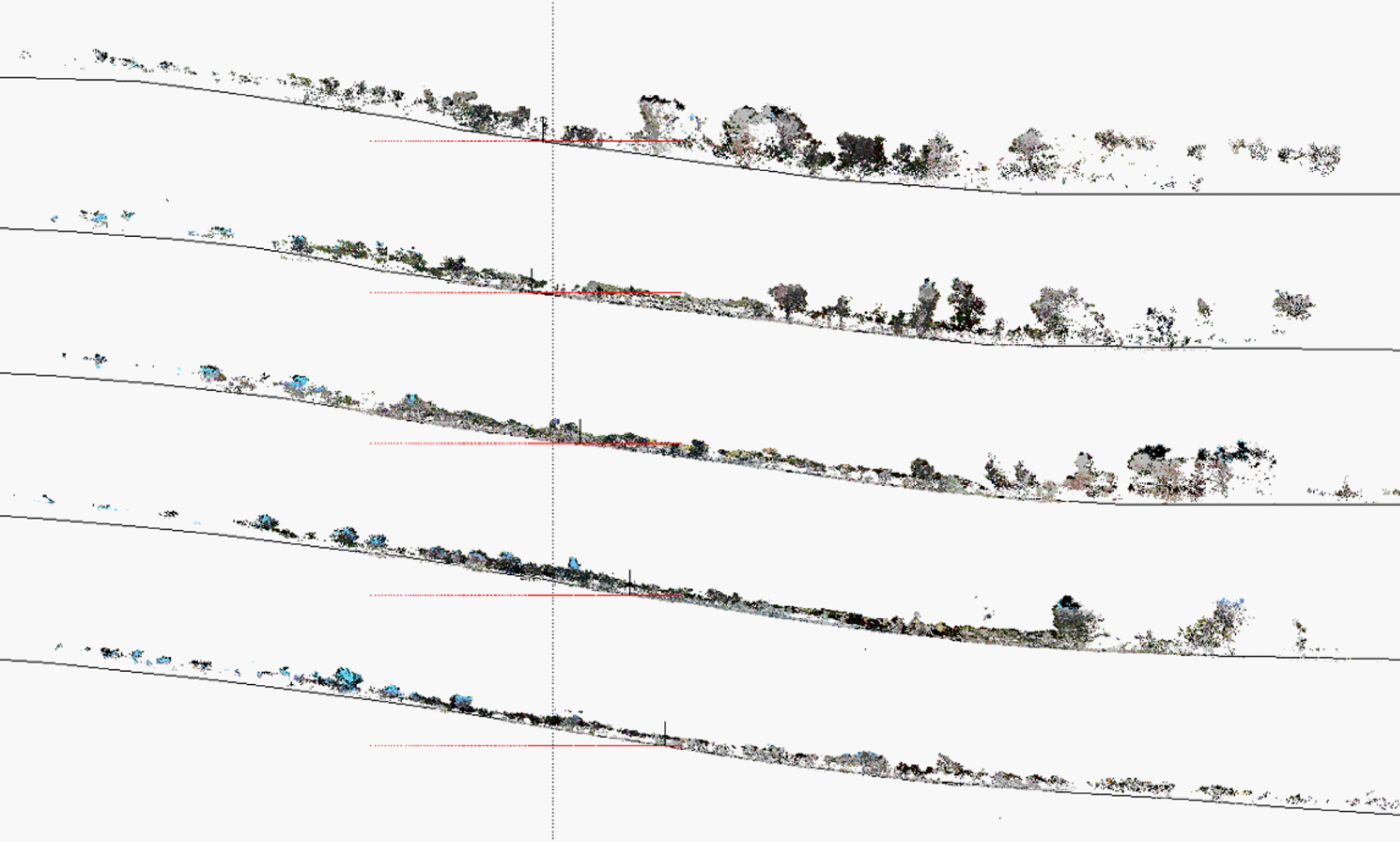
Coordinate Output from Laser Scanner



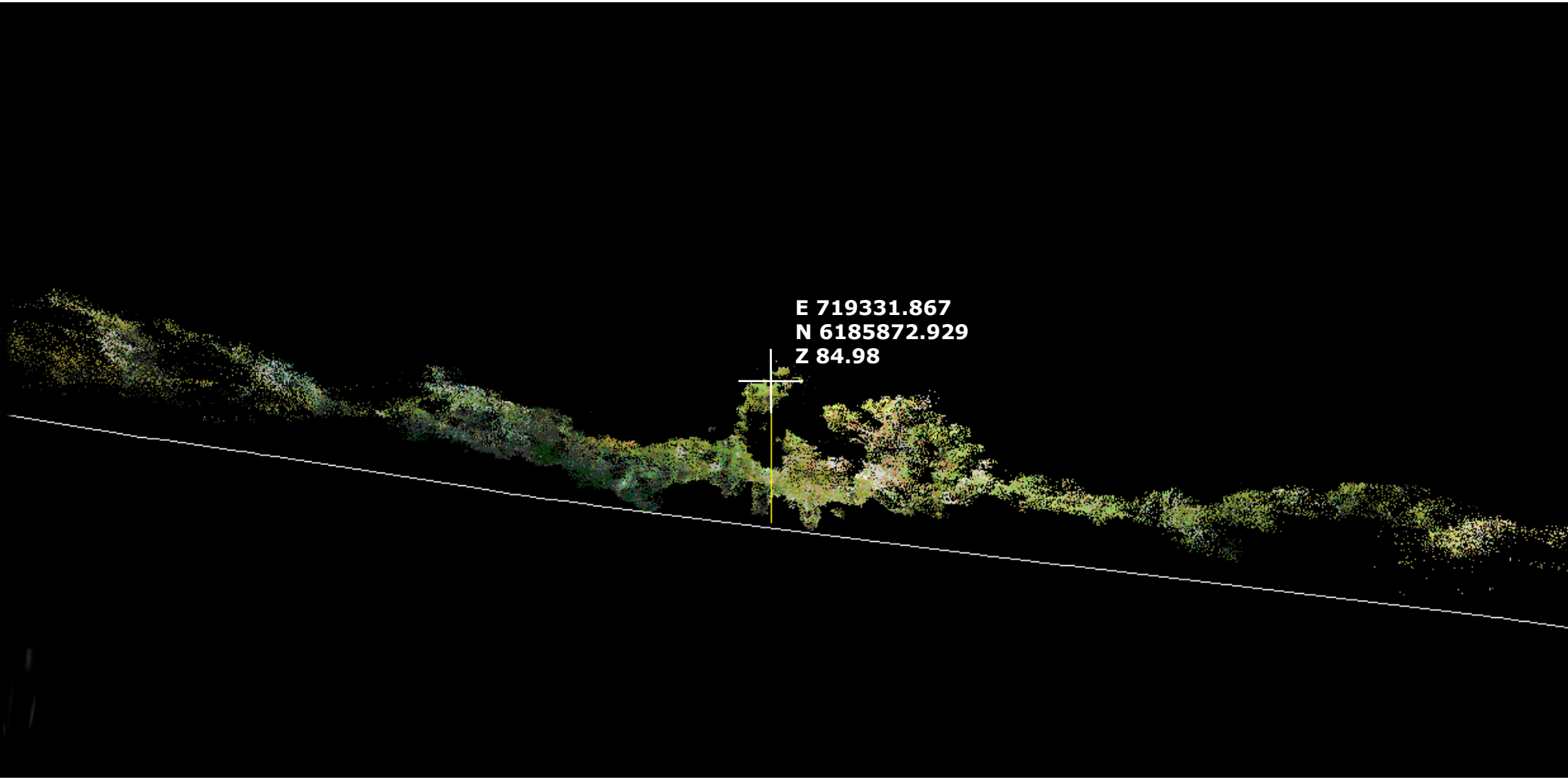
Contours processed from scanner coordinates. (100mm intervals)



Horizonal, 2005



Heathsections, 2005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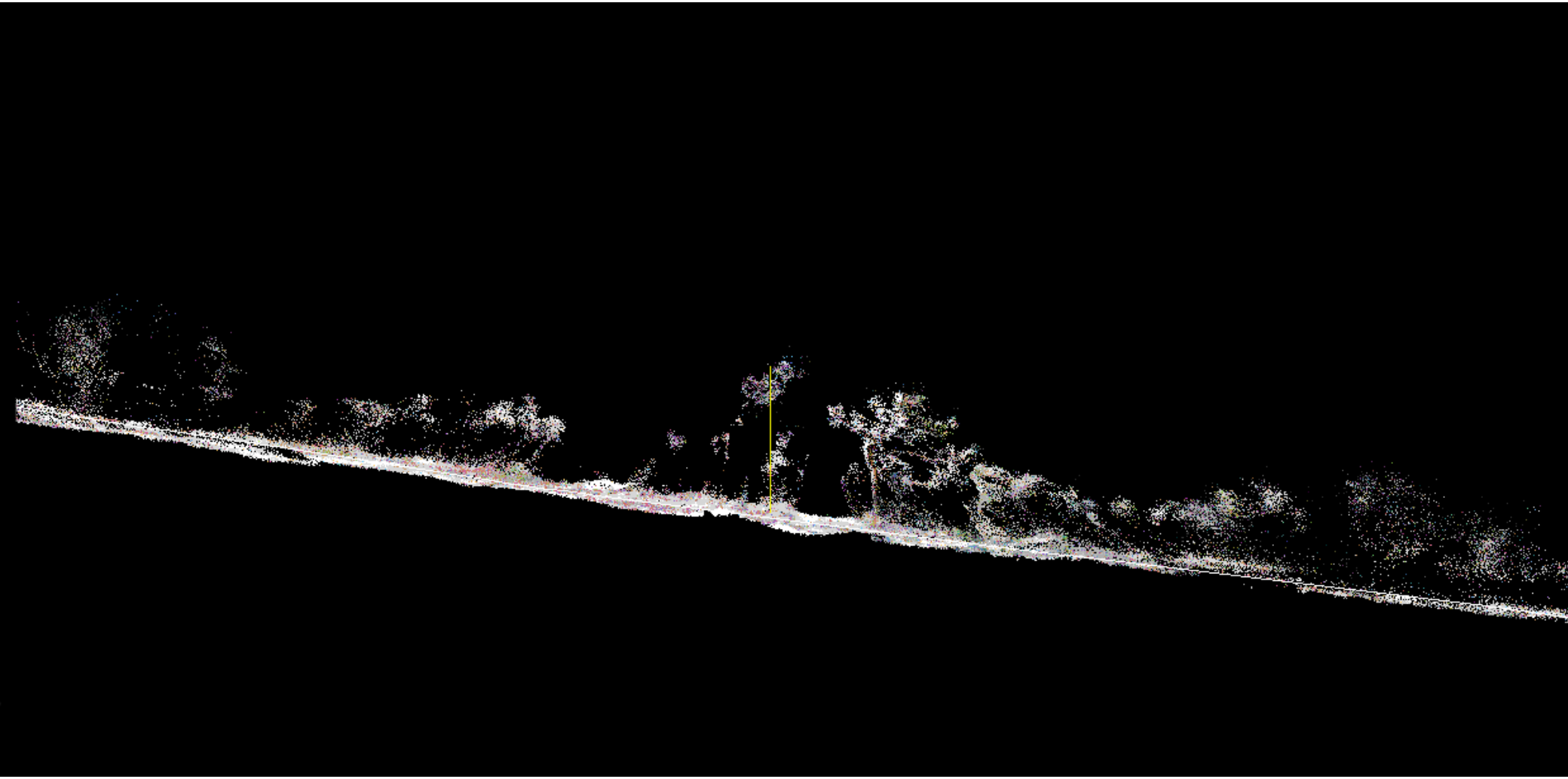
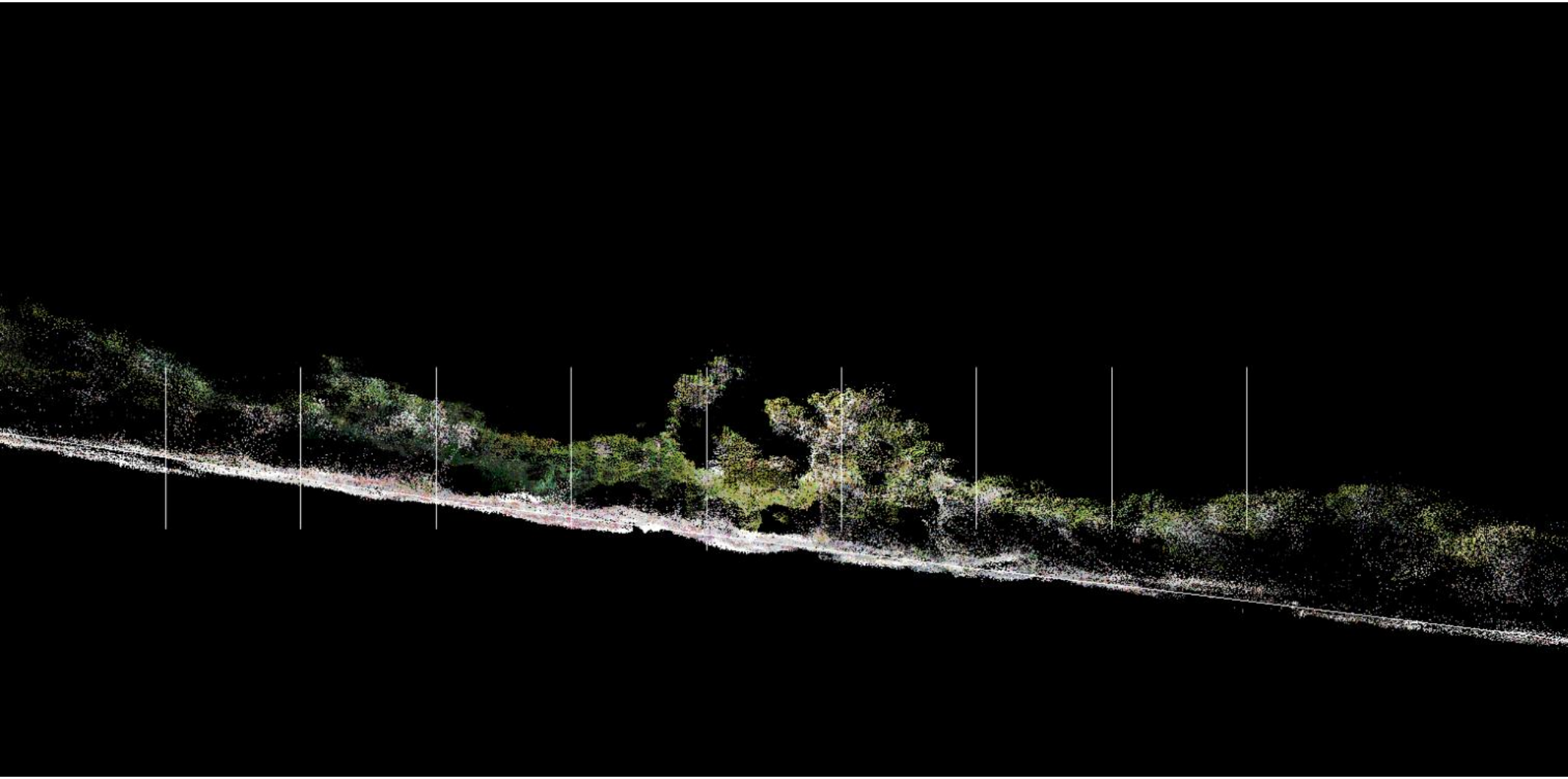
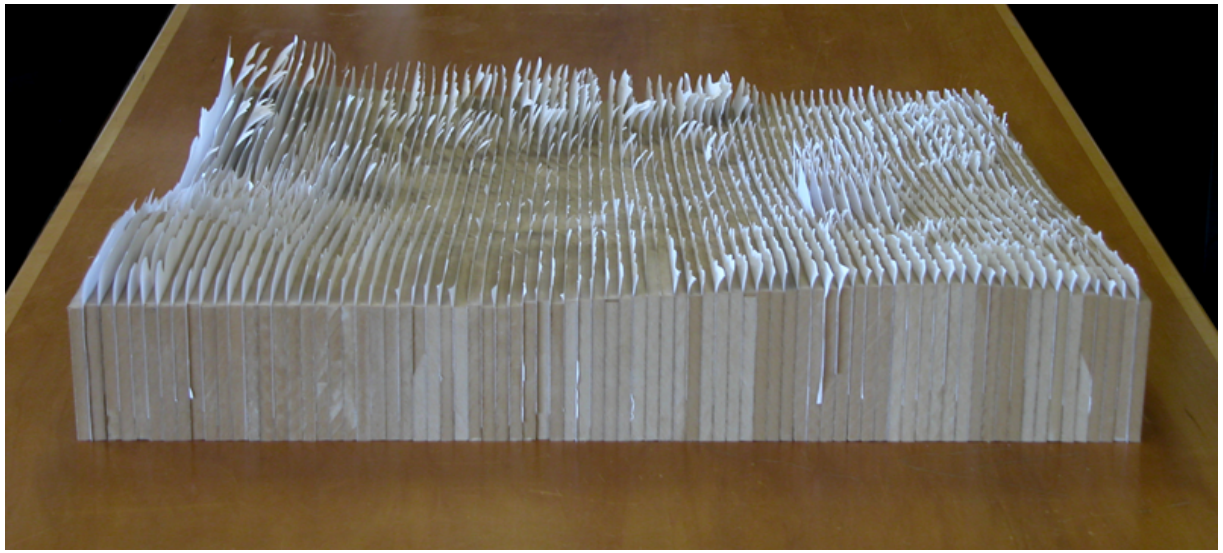
Point Henry Fire November 2002





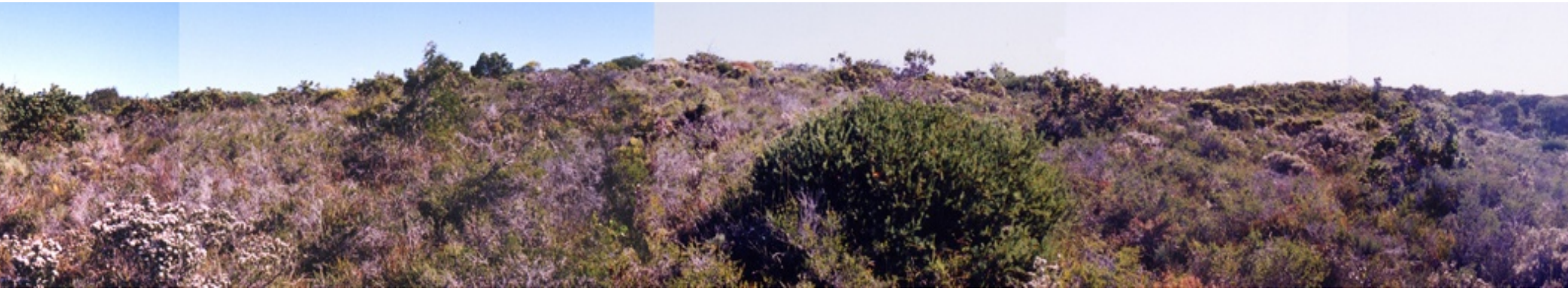
Before and after the fire, 2005



Site Model from *Heathsections*


ghtning strike
Prevailing WSW wind


Southerly wind change in late afternoon,
Fire heads North to township of Bremer Bay



Studio Context

Studio Context

Studio Context

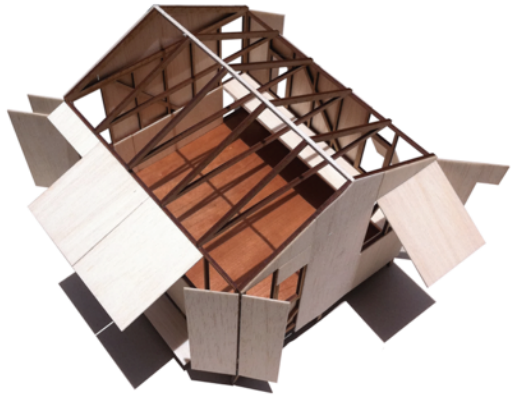

content too

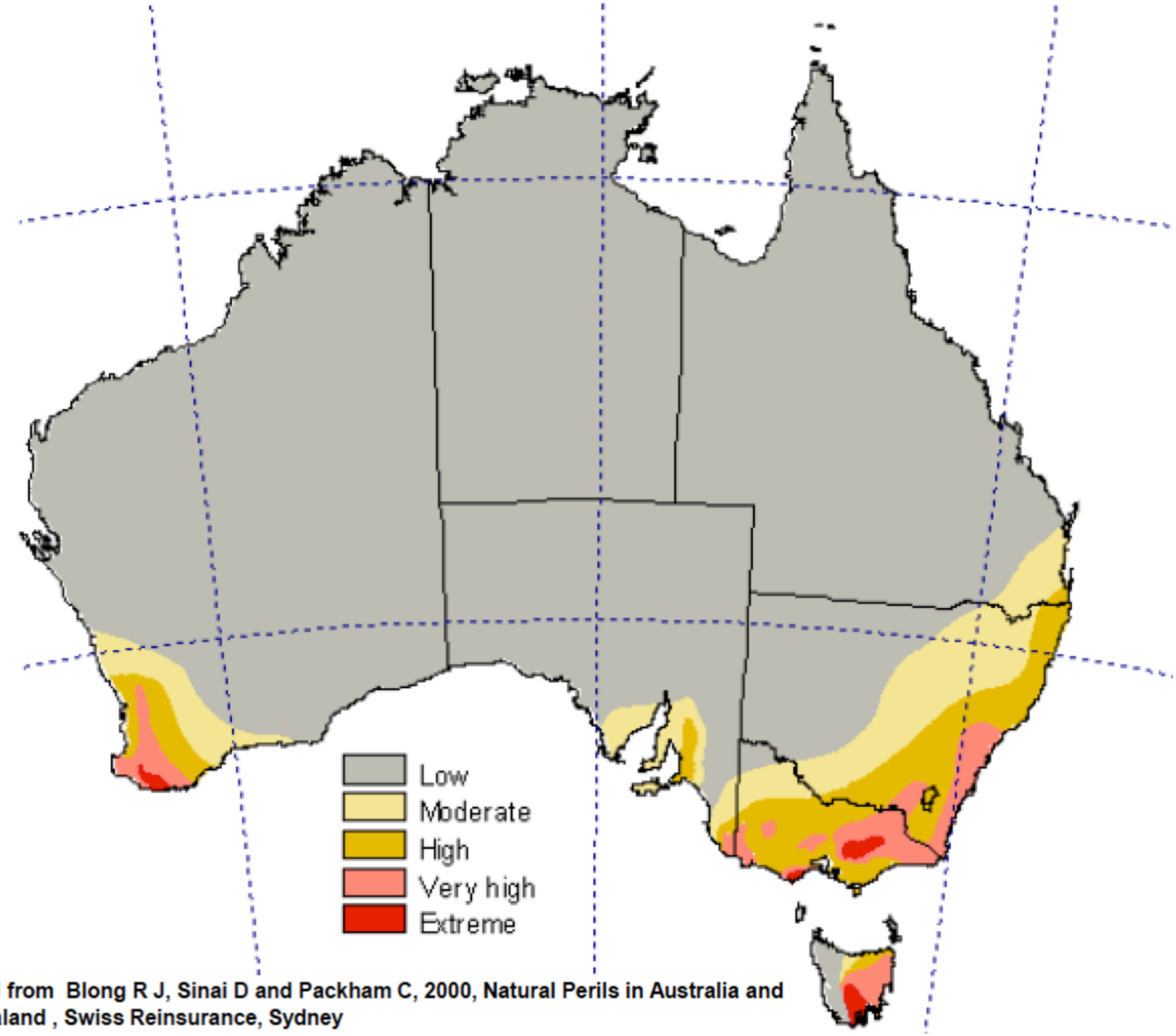

Lot 103
'CONTENT TOO'

Camera Botanica 1

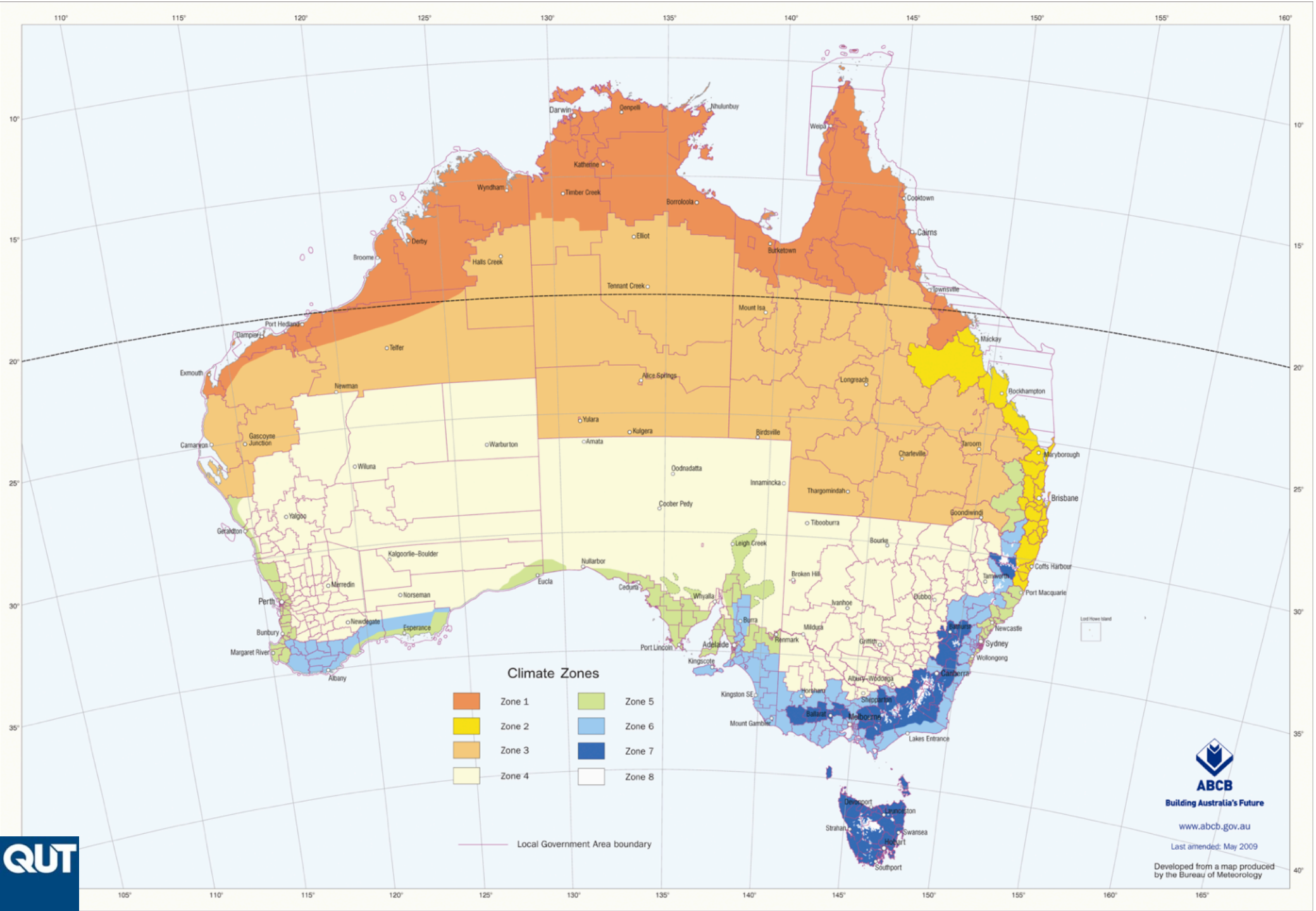
Bushfire Responsive Architecture BAL-FZ Flame Zone

Reconciling bushfire safety and biodiversity conservation with daily life





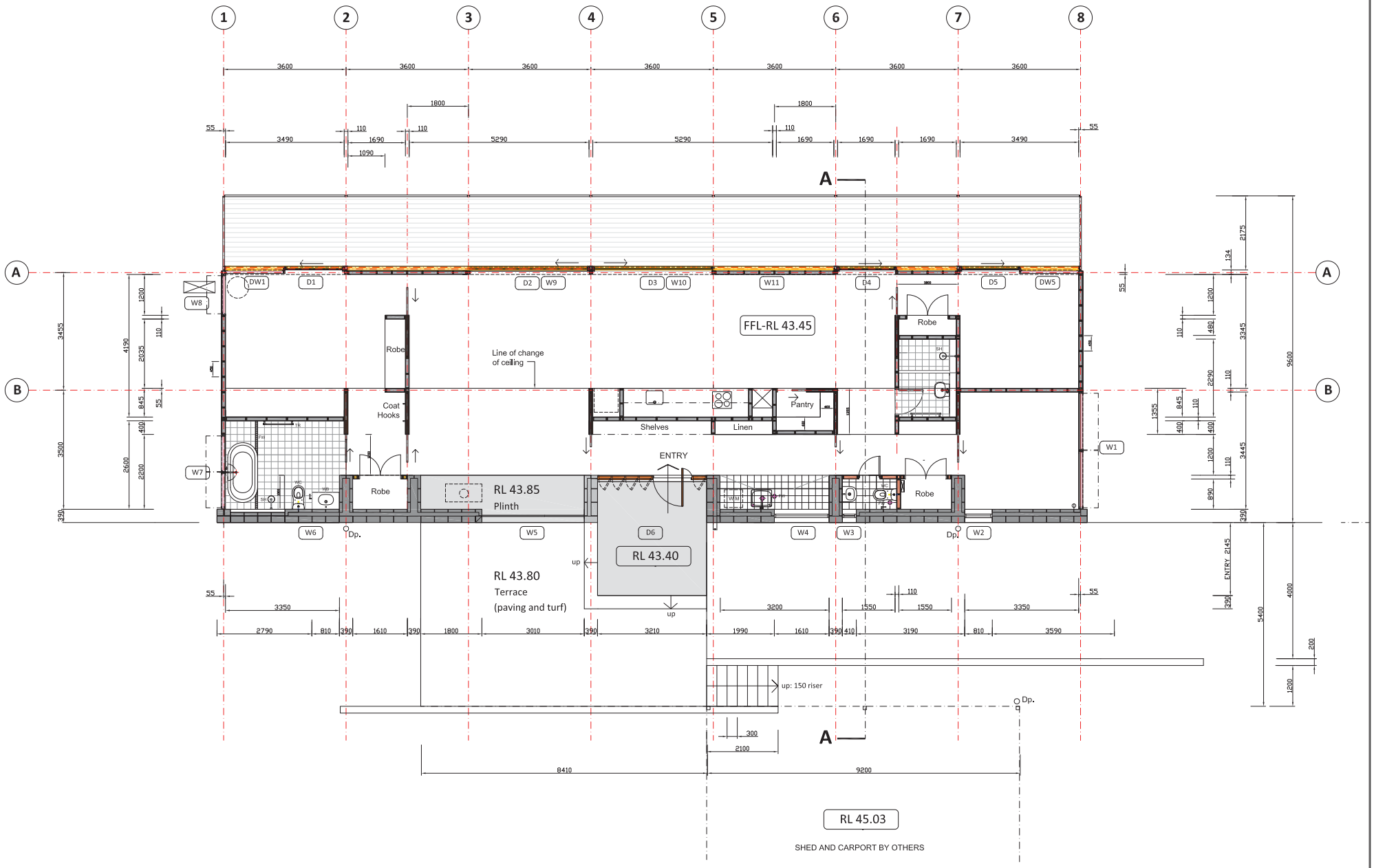
Adapted from Blong R J, Sinai D and Packham C, 2000, Natural Perils in Australia and New Zealand , Swiss Reinsurance, Sydney


Climate Zones
Zone 1
Zone 2
Zone 3
Zone 4
Zone 5
Zone 6
Zone 7
Zone 8
Local Government Area boundary
Darwin
Nhulunbuy
Weipa
Cooktown
Cairns
Townsville
Mackay
Rockhampton
Maryborough
Brisbane
Coffs Harbour
Port Macquarie
Newcastle
Sydney
Wollongong
Canberra
Lord Howe Island
Katherine
Timber Creek
Wyndham
Borroloola
Burketown
Elliot
Tennant Creek
Mount Isa
Halls Creek
Broome
Derby
Port Hedland
Dampier
Telfer
Exmouth
Newman
Alice Springs
Longreach
Birdsville
Yulara
Kulgera
Amata
Warburton
Gascoyne Junction
Carnarvon
Wiluna
Oodnadatta
Innamincka
Thargomindah
Charleville
Taroom
Goondiwindi
Tibooburra
Bourke
Coober Pedy
Leigh Creek
Yalgoo
Geraldton
Kalgoorlie–Boulder
Nullarbor
Eucla
Ceduna
Broken Hill
Dubbo
Ivanhoe
Whyalla
Burra
Mildura
Renmark
Griffith
Narrandera
Albury–Wodonga
Merredin
Norseman
Perth
Newdegate
Esperance
Bunbury
Margaret River
Albany
Port Lincoln
Adelaide
Kingscote
Kingston SE
Horsham
Shepparton
Ballarat
Melbourne
Mount Gambier
Lakes Entrance
Devonport
Launceston
Strahan
Swansea
Hobart
Southport
ABCB
Building Australia's Future
www.abcb.gov.au
Last amended: May 2009
Developed from a map produced by the Bureau of Meteorology
QUT

Karri House

Bushfire Responsive Architecture (BAL40)

Reconciling bushfire safety and biodiversity conservation with daily life



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DO NOT WORK FROM REDUCED SCALE DRAWINGS (A1-A3 SIZE PAPER).
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Faculty of the Built Environment & Engineering,
Queensland University of Technology.
Email: ian.weir@qut.edu.au
Telephone: (61) 155 151

Project: Ausma House	Scale @ A1: 1:50	Drawn by: IW	Title: Floor Plan
Date: 12/Mar/13	Checked: IW		
Lot 2 Wyman Trail, Ocean Beach Shire of Denmark			A2

December 2012


“Undefendable”

WAPC Conditions

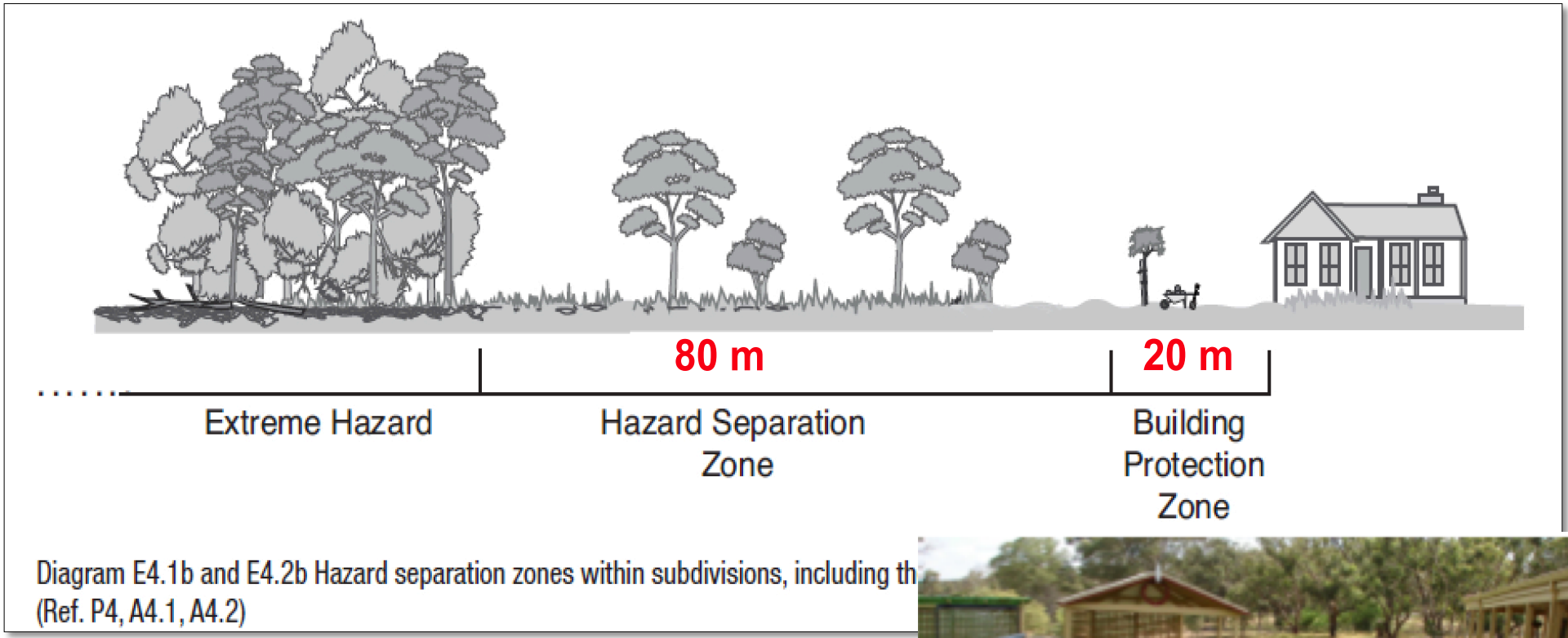


Diagram E4.1b and E4.2b Hazard separation zones within subdivisions, including th
(Ref. P4, A4.1, A4.2)

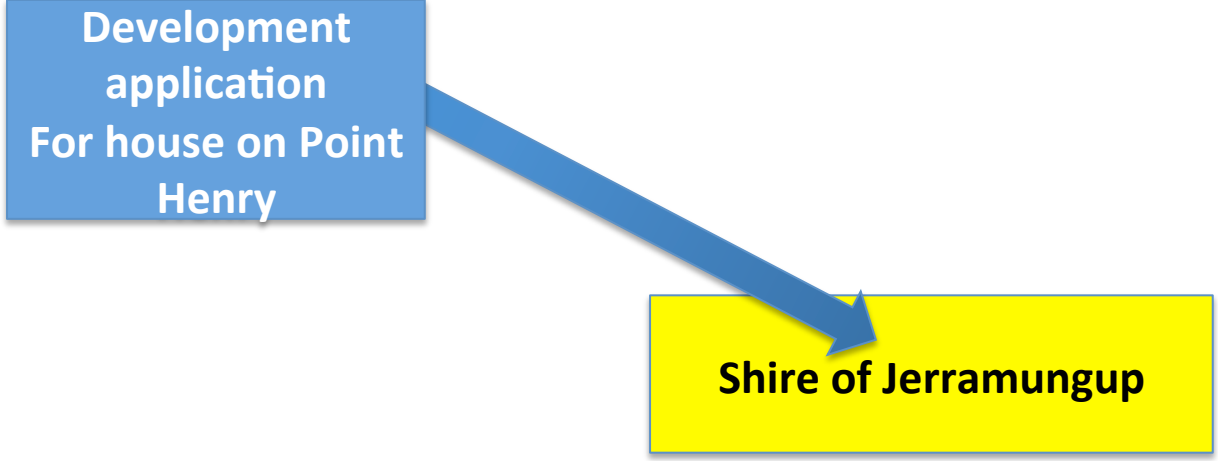
Development application For house on Point Henry

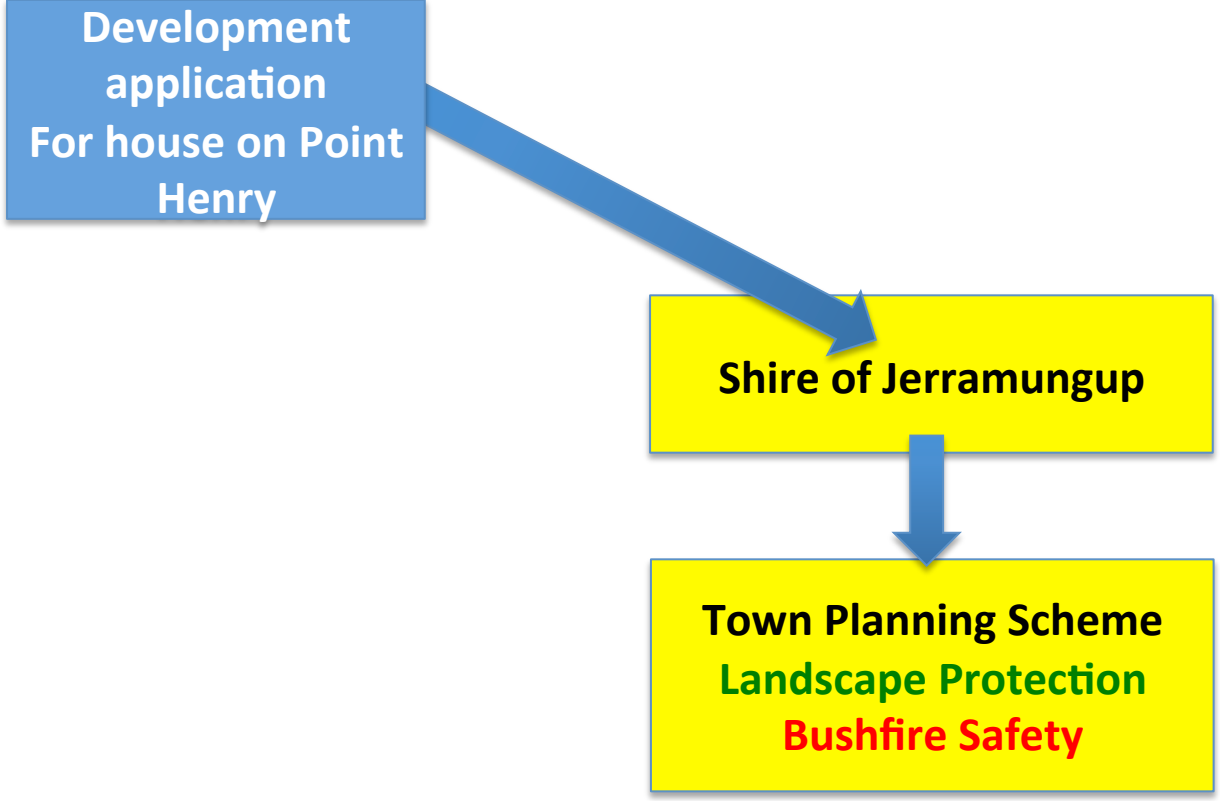
TYPICAL PLANNING PROCESS

Development application For house on Point Henry

TYPICAL PLANNING PROCESS

‘THE ACCEPTABLE SOLUTION PROBLEM’

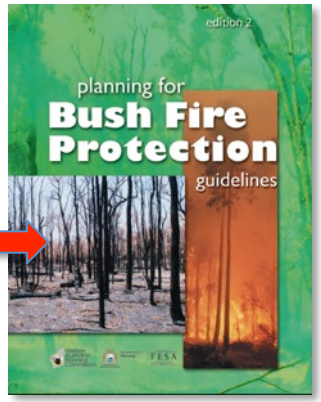

Development application For house on Point Henry
Shire of Jerramungup


Development application For house on Point Henry
Shire of Jerramungup
Town Planning Scheme
Landscape Protection
Bushfire Safety

Development application For house on Point Henry

Shire of Jerramungup

Town Planning Scheme
Landscape Protection
Bushfire Safety



Development application
For house on Point Henry

Shire of Jerramungup

Town Planning Scheme
Landscape Protection
Bushfire Safety

WAPC
'Acceptable Solutions'

Development application
For house on Point Henry

Shire of Jerramungup

Town Planning Scheme
Landscape Protection
Bushfire Safety

WAPC
'Acceptable Solutions'

20 m BPZ mandated via Firebreak Notice

Visual Impact Minimization Objectives

‘Acceptable Solution’ - via planning approval process or fire break notice.

(photomontage)

Visual Impact Minimization Objectives

Cottage at Short Beach before proposed Bushfire Strategy

WAPC acceptable solution - via planning approval process.
or fire break notice.

(photomontage)

Short Beach House

<u>Justifiable variation to 20m BPZ rule</u>


20m BPZ

A 20 m BPZ approach doesn't guarantee building survival. Vegetation management is not passive protection

Bushfire Planning Conditions

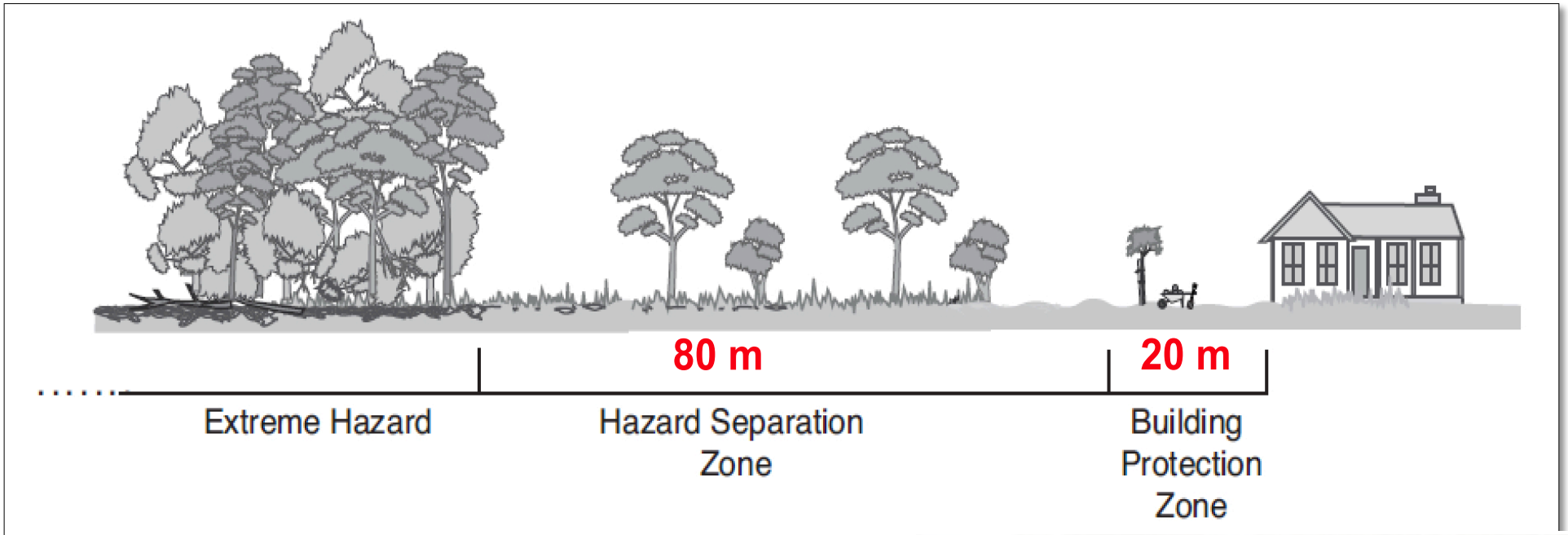


Diagram E4.1b and E4.2b Hazard separation zones within subdivisions, including th
(Ref. P4, A4.1, A4.2)

Source: I weir

Houses burn trees

Source: I weir

AS3959 – Determining the BAL

BAL-LOW **Very Low risk**

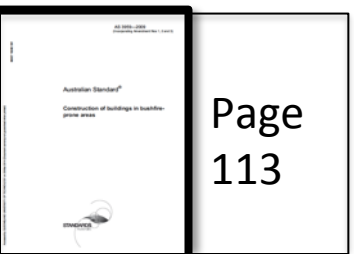
BAL-12.5 **Low Risk**
Ember attack & radiant heat up to an including 12.5 kW/m2

BAL-19 **Moderate**
12.5 – 19 kW/m^2

BAL-29 **High**
19 – 29 kW/m^2

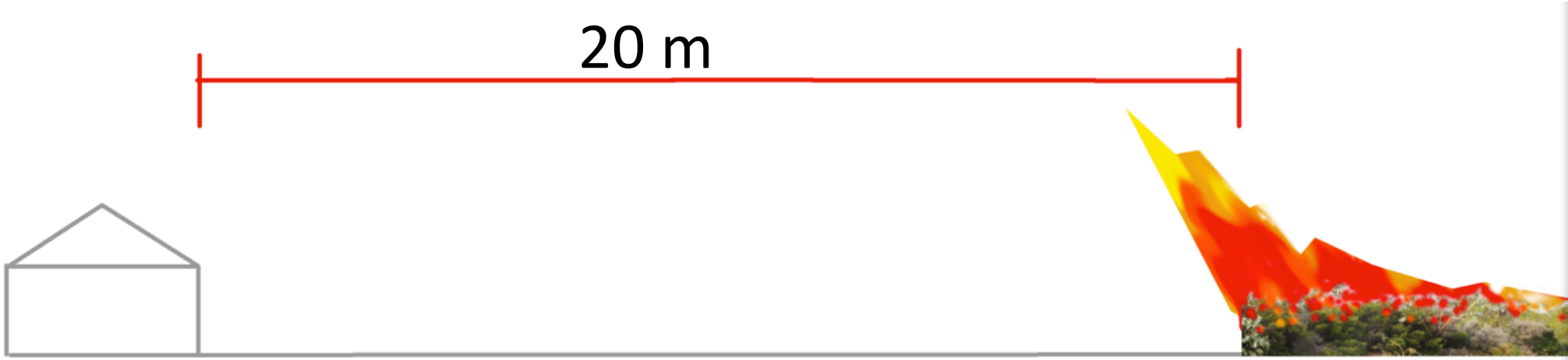
BAL-40 **Very High**
Ember attack, increased likelihood of flame contact & radiant heat 29 – 40 kW/m^2

BAL-FZ **Extreme – Flame Zone**
40+ kW/m^2 - ember attack, burning debris, direct exposure of flames from the fire

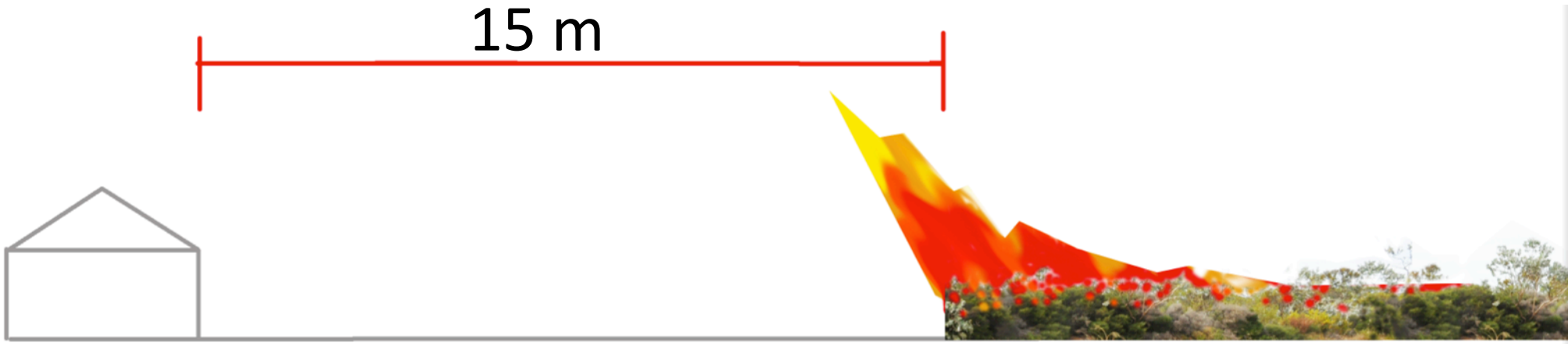


Page 113

BAL – 12.5 (@ 15 t/ha)

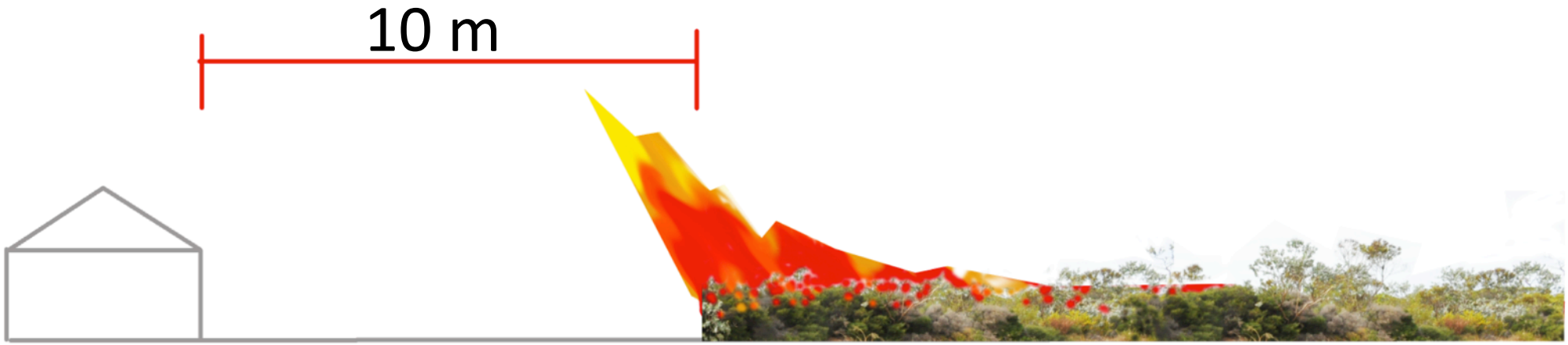


BAL – 19 (@ 15 t/ha)


15 m


Australian Standard
Construction of buildings in bushfire-prone areas

BAL – 29 (@ 15 t/ha)


10 m


Australian Standard
Construction of buildings in bushfire-prone areas

BAL – 40 @ 15 t/ha)

BAL – FZ (@ 15 t/ha)


5 m


Australian Standard
Construction of buildings in bushfire-prone areas

CSIRO

Submission to Black Saturday Royal Commission

AS3959 – Determining the BAL

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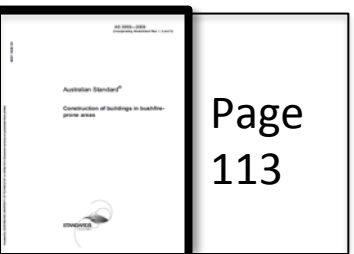


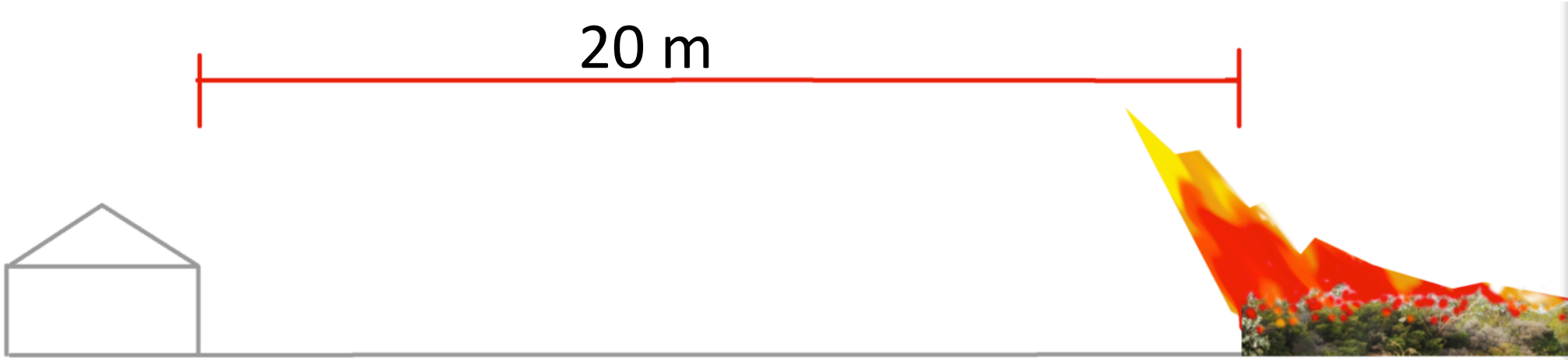
Page 113

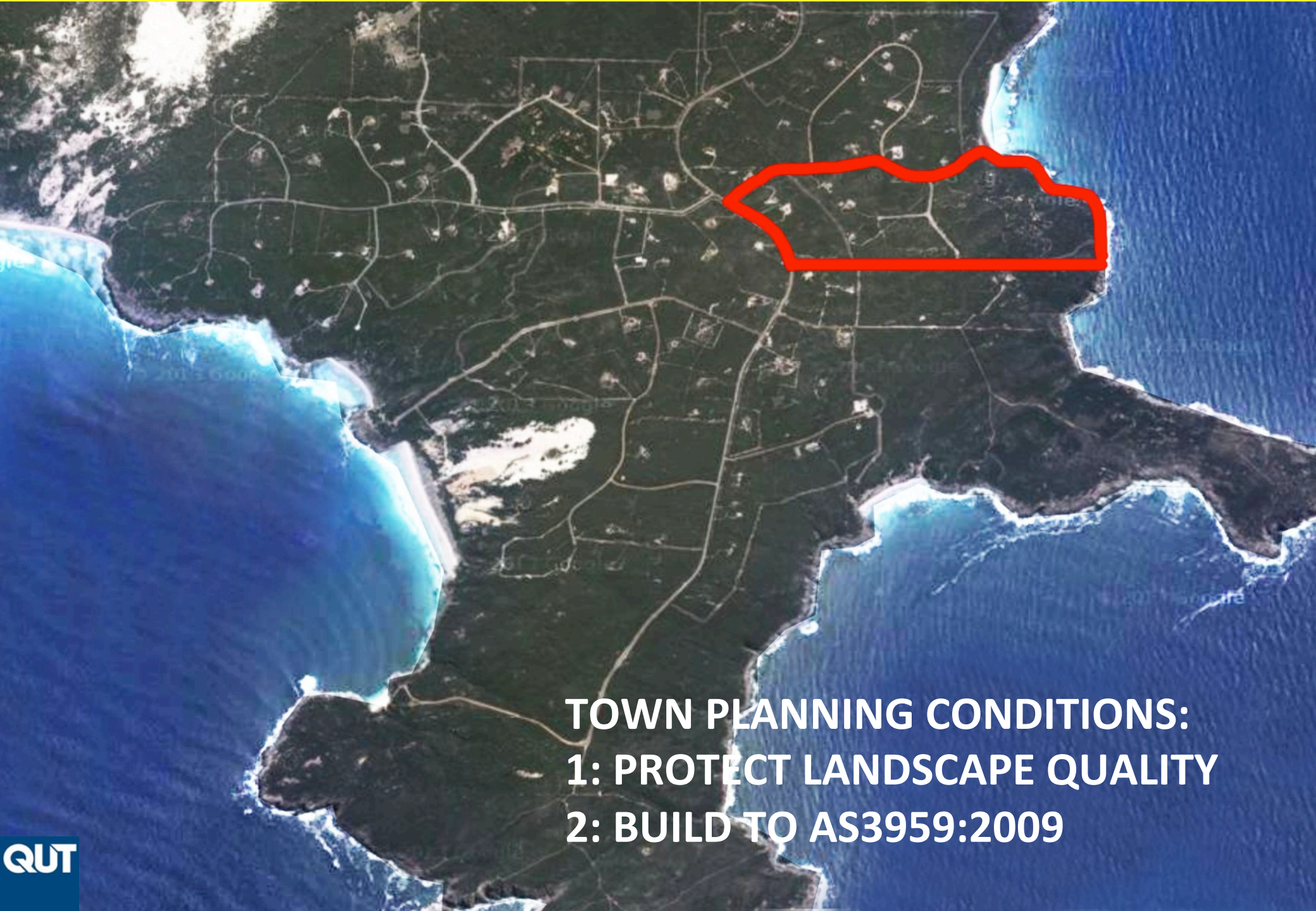
BAL – FZ (@ 15 t/ha)

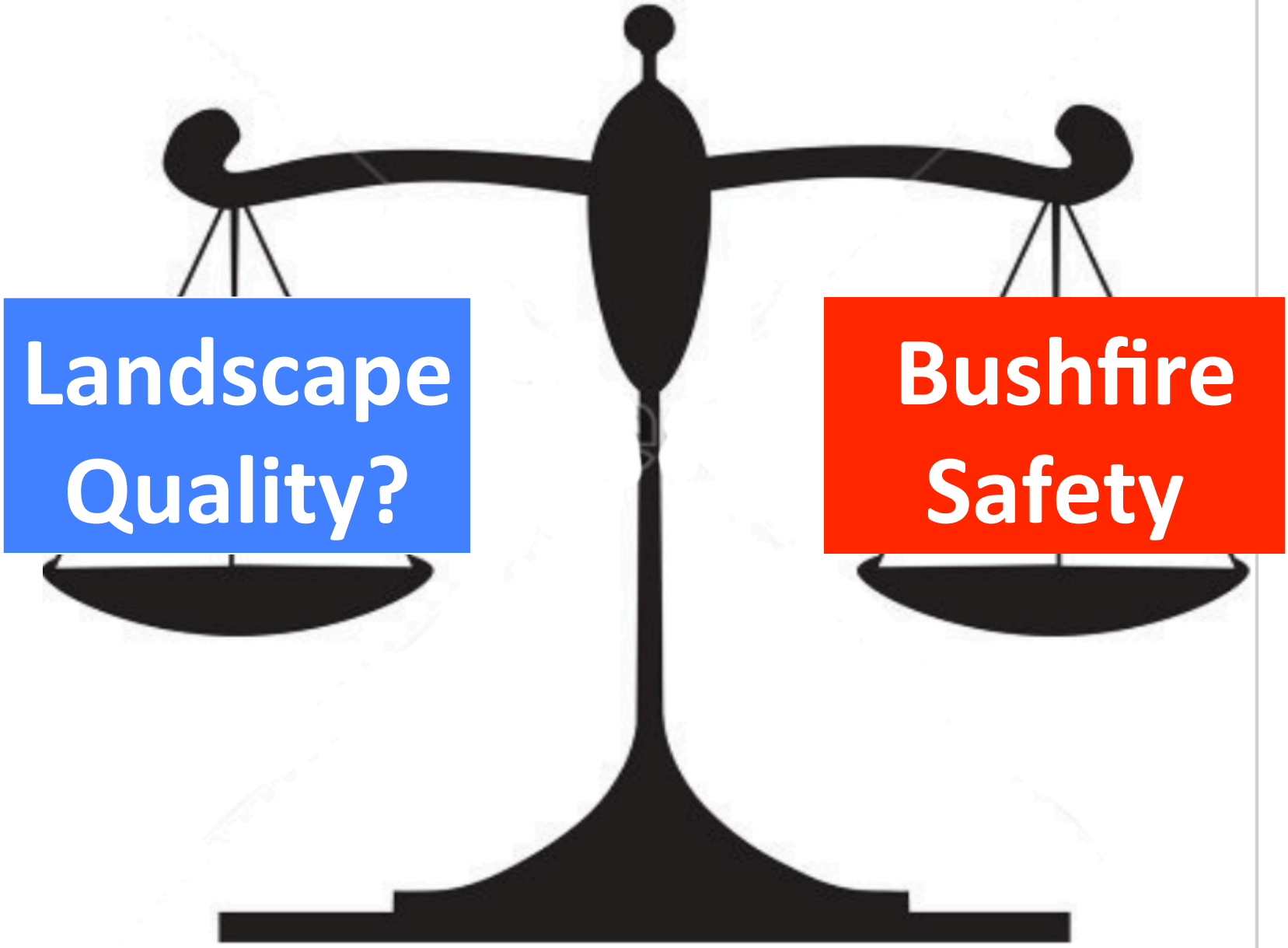

5 m


Australian Standard
Construction of buildings in bushfire-prone areas

BAL – 12.5 (@ 15 t/ha)

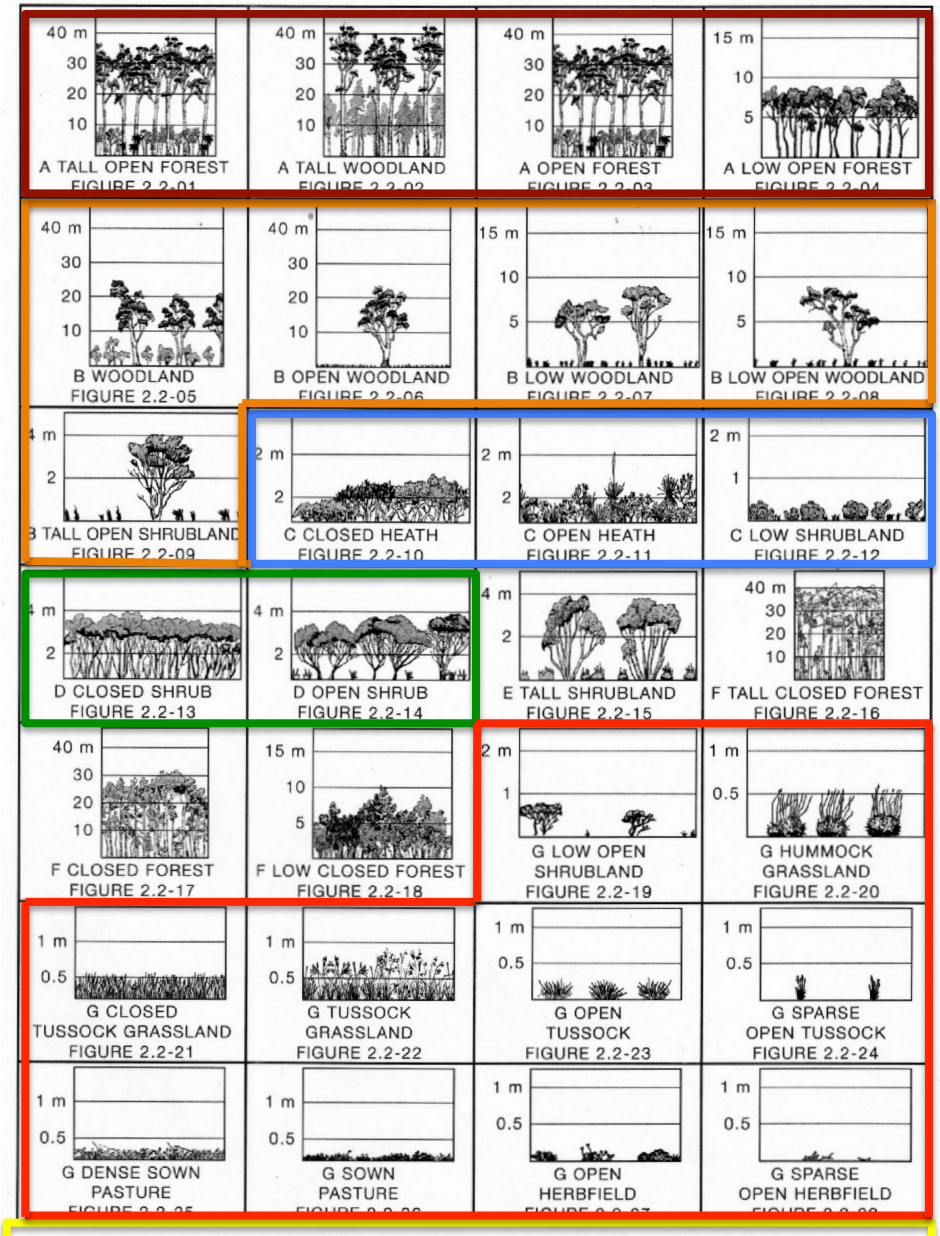



TOWN PLANNING CONDITIONS:
1: PROTECT LANDSCAPE QUALITY
2: BUILD TO AS3959:2009


Landscape Quality?
Bushfire Safety

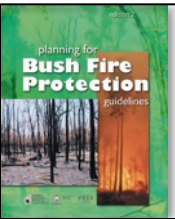

AS3959
Western Australian Planning Commission
Planning Bulletin 111/2013
Planning for Bushfire
111/2013
December 2013
1. Policy intent
2. Introduction and purpose
edition 2
planning for
AS 3959—2009
(Incorporating Amendment Nos 1, 2 and 3)
Australian Standard®
Construction of buildings in bushfire-prone areas
STANDARDS

WAPC Guidelines - fuel load classification



Source: "AS 3959 - 2009 Construction of buildings in bushfire-prone areas" published by Standards Australia, Sydney.

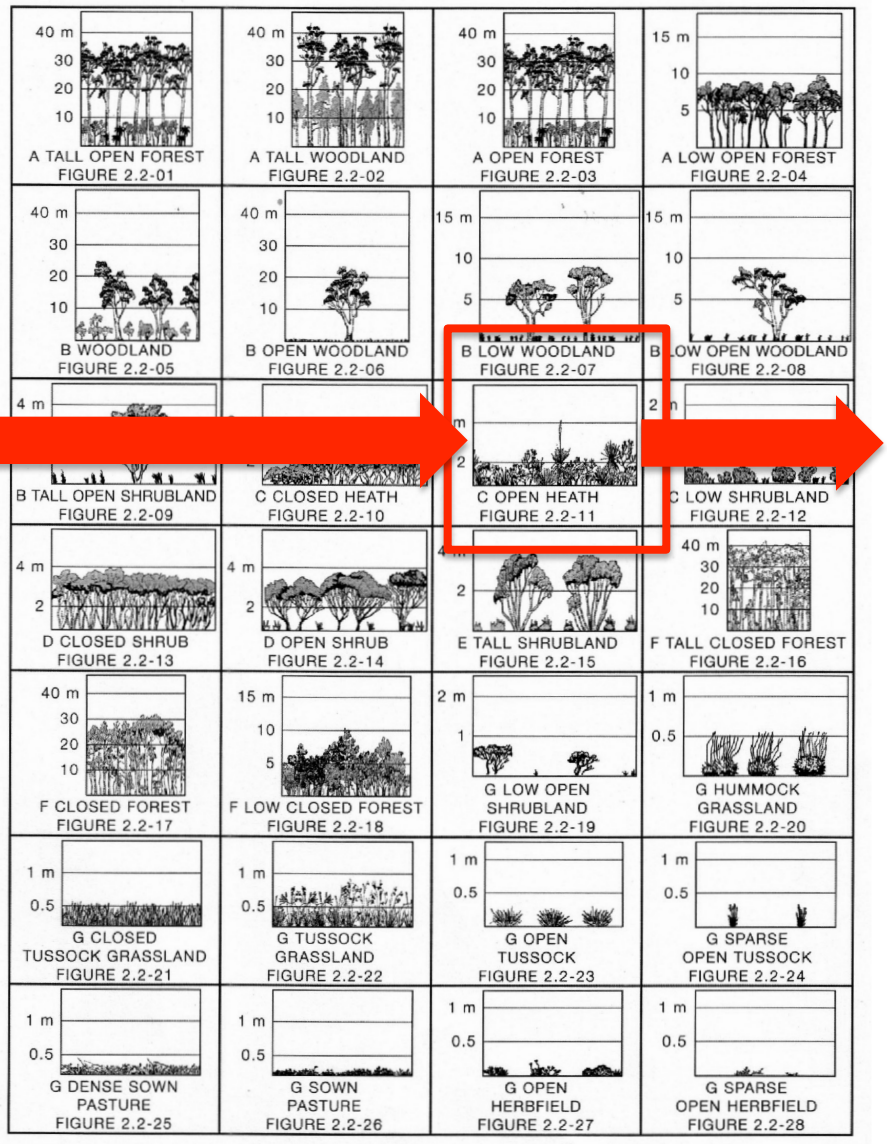
	AS3959:2009 Surface Fuel	AS3959:2009 Overall Fuel
A TALL OPEN FOREST A TALL WOODLAND A OPEN FOREST A LOW OPEN FOREST	25 t/ha	35 t/ha
B WOODLAND B OPEN WOODLAND B LOW WOODLAND B LOW OPEN WOODLAND	15 t/ha	25 t/ha
TALL OPEN SHRUBLAND C CLOSED HEATH C OPEN HEATH C LOW SHRUBLAND	15 t/ha	15 t/ha
D CLOSED SHRUB D OPEN SHRUB E TALL SHRUBLAND F TALL CLOSED FOREST	25 t/ha	25 t/ha
F CLOSED FOREST F LOW CLOSED FOREST G LOW OPEN SHRUBLAND G HUMMOCK GRASSLAND G CLOSED TUSSOCK GRASSLAND G TUSSOCK GRASSLAND G OPEN TUSSOCK G SPARSE OPEN TUSSOCK G DENSE SOWN PASTURE G SOWN PASTURE G OPEN HERBFIELD G SPARSE OPEN HERBFIELD	4.5 t/ha	4.5 t/ha



Page 22

Standard Method 1 BAL Assessment AS3959

Heath East of Point Henry Rd
Using FESA Visual Fuel Load Guide
= 4-5 t/ha



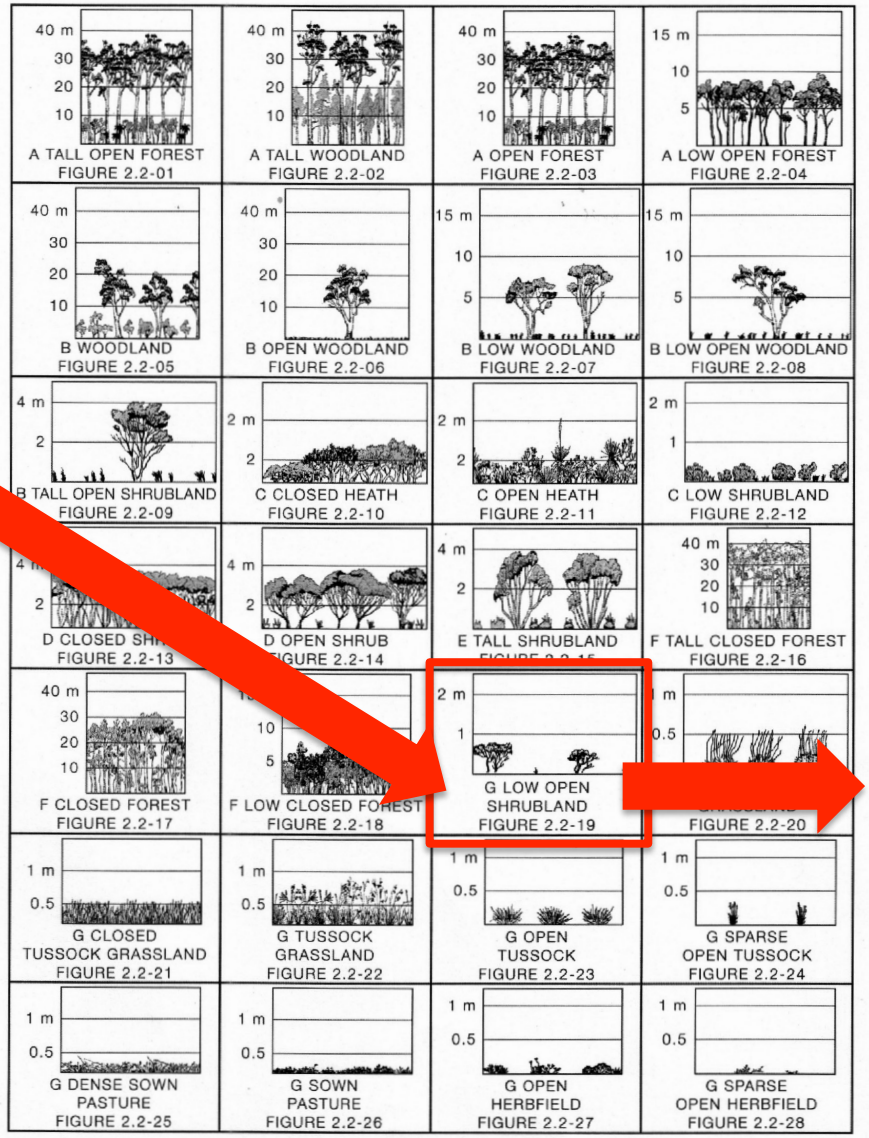
15 t/ha!

Source: "AS 3959 - 2009 Construction of buildings in bushfire-prone areas" published by Standards Australia, Sydney.

age
22

FESA/DFES Guidelines fuel load classification

4-5 t/ha



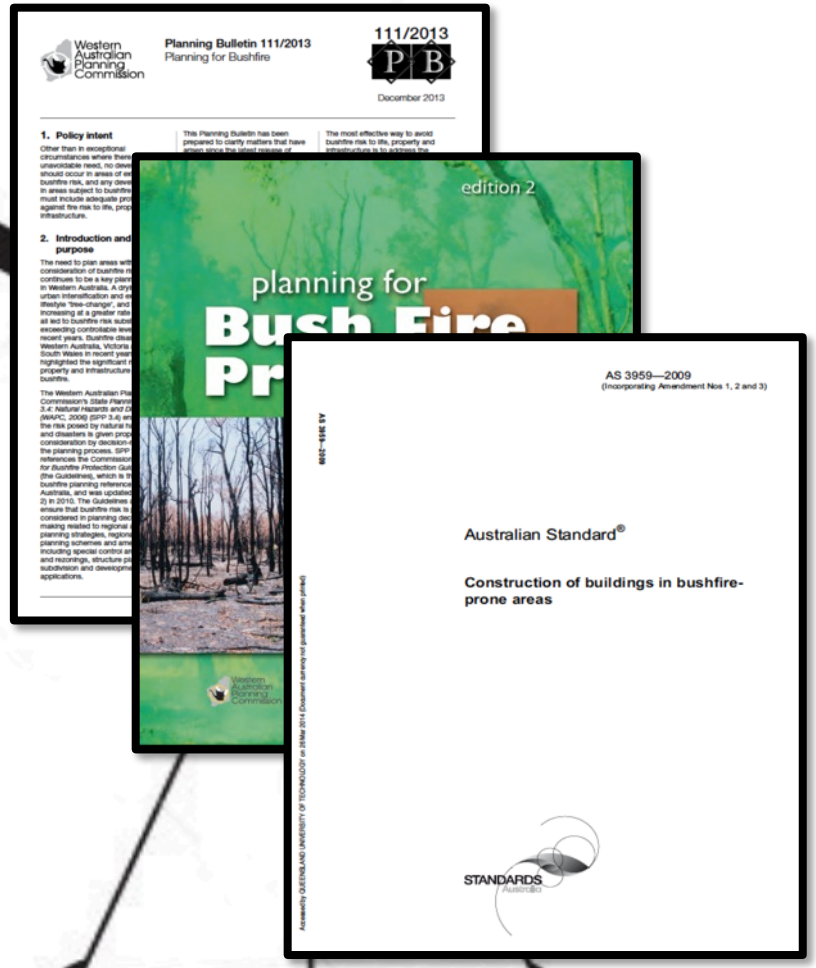
4.5 t/ha

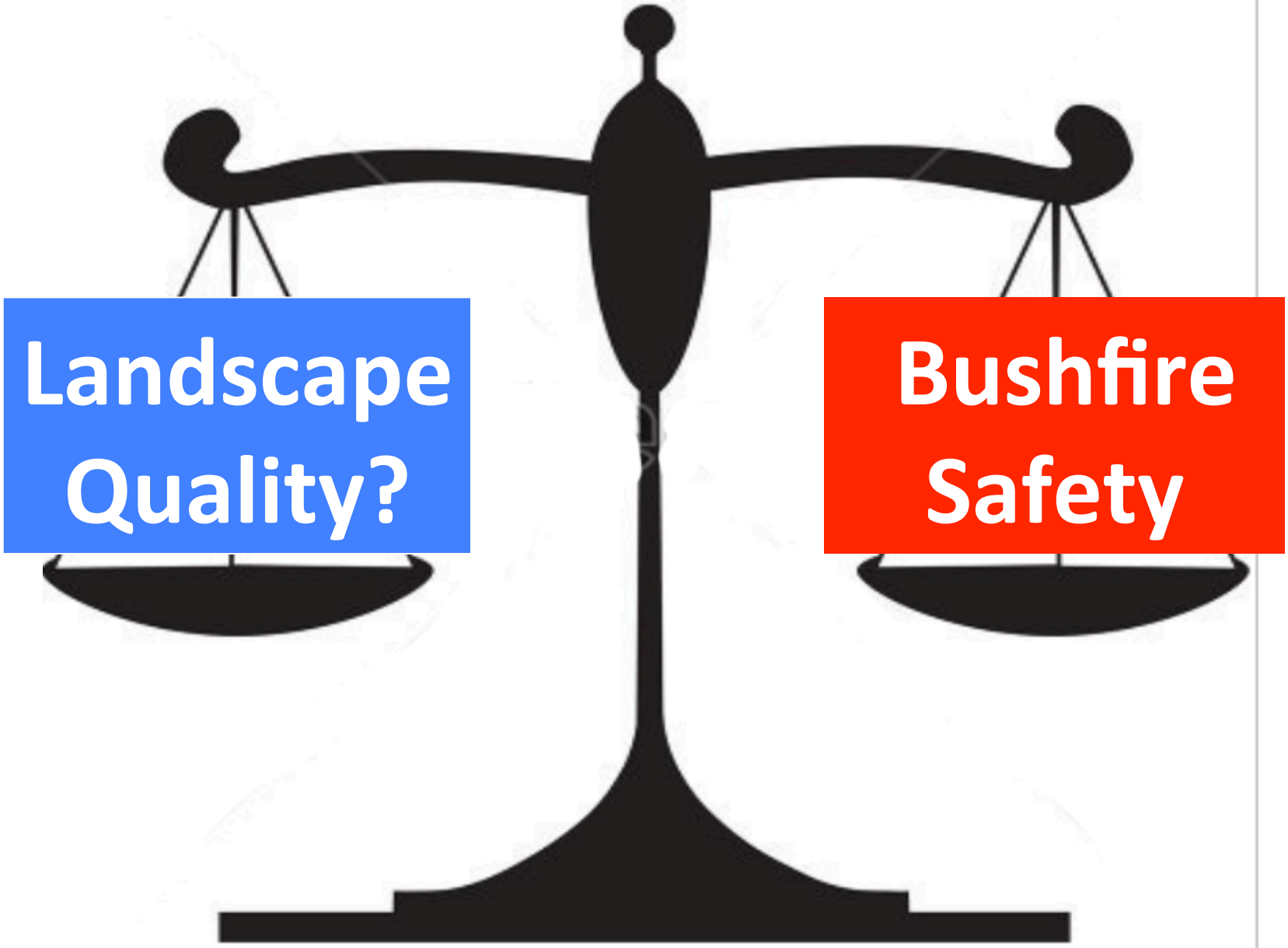
Page 22

Source: "AS 3959 - 2009 Construction of buildings in bushfire-prone areas" published by Standards Australia, Sydney.

Landscape Quality?

AS3959




Landscape Quality?
Bushfire Safety

LOT 103

CONTENT TOO

Australian Government
Department of the Environment

Proteaceae Dominated Kwongkan Shrubland: a nationally-protected ecological community

This guide is intended to help the public understand what the Proteaceae Dominated Kwongkan Shrubland ecological community is, why it is nationally protected, what the listing aims to achieve, and what the listing means for people in the region.

In summary:

- The Proteaceae Dominated Kwongkan Shrubland ecological community is now listed as endangered and protected under Australia's national environment law, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- The ecological community is found within the south coast region of Western Australia, and is dominated by flowering shrub species from the Proteaceae family (e.g. Banksias, Grevilleas, Hakeas).
- The national Threatened Species Scientific Committee found that the ecological community has undergone a severe reduction in integrity, and has a fragmented geographic distribution that means it is under a severe level of threat over the near future.
- The intent of the listing is to prevent its decline and to provide support to on-ground efforts that ensure its long-term survival and recovery. The Threatened Species Scientific Committee's **conservation advice** outlines a range of priority research and management actions that provide guidance on how to manage, restore and protect the ecological community.
- The listing promotes a co-ordinated, ecosystem-scale approach to threat abatement in the region and supports existing national protection of many threatened species that are found within the ecological community.
- Listing under the EPBC Act means that an activity that is likely to have a significant impact on the ecological community will need to be referred for an environmental impact assessment and approval.
- Routine property maintenance and land management practices carried out in line with laws and guidelines covering native vegetation are typically unlikely to require referral under national environment law. This includes most farming activities.
- The national environment law is triggered by activities that are likely to have a significant adverse impact on a listed ecological community; activities such as large new developments, works or infrastructures. For example, activities that involve permanently clearing large areas of intact and high-quality native vegetation.

BIO322.0214

Barb Miller-Hornsey's Botanical Survey

Lots 103 and 104, Point Henry Rd, 2006

109 Botanical Species

Acacia cochlearis
Acacia littorea
Acacia myrtifolia "Myrtle Wattle"
Acacia sp. (Unidentified)
Agonis flexuosa "Weeping Peppermint"
Alocasuarina sp. Common
Anthocereis littorea "Yellow-tail Flower"
Asparagus asparagnoides "Bridal Creeper"
Banksia nutans
Bossaeia praetermissa
Burnettia nigricans "Potato Orchid"
Caladenia bicalliata "Limestone Spider Orchid"
Caladenia cairnsiana "Zebra Orchid"
Caladenia flava "Cowslip Orchid"
Caladenia latifolia "Pink Fairy Orchid"
Caladenia longicauda, subsp. australora "Southern White Spider Orchid"
Carpobrotus virescens "Native Pig Face"
Chamaescilla corymbose
Chorizema ilicifolium "Holly Flame Pea"
Clematis 2
Clematis pubescens
Comesperma confertum
Comesperma polygaloides
Cyanicula gemmata "Blue China Orchid"
Dianella revolute
Drandra sessilis "Parrott Bush"
Drosera macrantha "White Rainbow"
Dryandra nivea "Crouched Honey-pot"
Elythranthera brunonis "Purple Enamel Orchid"
Eriochilus dilitatus, subsp. Magnus "Baby Bunny Orchid"
Eucalyptus angulosa "Ridge-fruited Mallee"
Euphorbia paralis "Milkweed" (Introduced)
Gompholobium confertum
Gompholobium tomentosum prevalent
Ground Cover (Unidenfied)
Ground Cover 1
Hakea corymbosa "Cauliflower Hakea"
Hakea oleifolia "Mungup Tree"
Hakea prostrata "Harsh Hakea"
Hakea ruscifolia 3
Hakea varia
Hibbertia amplexicaulis
Hibbertia cuneiformis "Cut-leaf Hibbertia"
Hibbertia racemosa "Stalked Guinea Flower"
Homalosciadium homalocarpum
Isopogon formosus "Rose Coneflower"
Isotropis cunefolia "Lamb Poison"
Jacksonia furcellata 3
Jacksonia spinosa common
Kennedia nigricans "Black Kennedia"
Kennedia nigricans "Black Kennedia"
Kennedia prostrata "Running Postman"
Lagenifera stiptata
Lepidosperma sp. (angustatum)
Leptoceras menziesii "Rabbit Orchid"
Leschenaultia tubiflora
Leucipogon parviflorus "Coast Beard Heath"
Leucopogon gibbosus
Leucopogon obovatus common
Leucopogon sp.
Linum marginale "Native Flax"
Logania serpyllifolia
Lysinema ciliatum
Melaleuca thymoides
Melaleuca thymoides
Meuhlenbeckia adpressa "Sarsparilla Vine"
Microtis brownii "Sweet Mignonette Orchid"
Microtis media "Common Mignonette Orchid"
Moss
Olax phyllantanthi
Olearia axillaris "Coast Daisy Bush"
Olearia ciliata "Fringed Daisy Bush"
Onopordum acanthium "Scotch Thistle" (Introduced)
Opercularia ?hispidula
Patersonia ocidentalis
Pelargonium littorale
Phyllanthus calycinus "False Boronia"
Pimelea sp. (P. drummondii)
Pimelia ferruginea
Platysace compressa "Tapeworm Plant"
Podetheca angustifolia "Sticky hang-heads"
Podetheca gnaphalioides "Golden Long-heads"
Pomaderris myrtilliodes
Prasophyllum fimbria "Fringed Leek Orchid"
Prasophyllum sp. (P. triangulare)
Pultenaea obcordatum
Pultenaea obcordatum
Pultenea tenuifolia
Regelia inops
Restio sp.
Scaevola crassifolia "Thick-leafed Fan-flower"
Sedge 1
Sedge 2
Senecio lautus, subsp. dissectifolius
Solanum laciniatum "Kangaroo Apple"
Sphaerolobium vimineum "Leafless Globe Pea"
Spheralobium vimineum
Spyridium globulosum
Stylidium adnatum "Common Bearded Trigger Plant"
Templetonia retusa Cocky's Tongues
Thysanotis multiflorus
Thysanous patersonii "Climbing Fringed Lilly"
Unidentified red plant
Waitzia accuminata "Golden Waitzia"
Waitzia sauveolens "fragrant Waitzia"
Wheat grass 1
Wheat grass 2
Wheatgrass 3
Xanthorea brevstylis


Australian Government
Department of the Environment
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environment.gov.au
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Construction of buildings in bushfire-prone areas
STANDARDS


UNESCO
Fitzgerald Biosphere Region

Murrindindi

Murrindindi Vic, post Black Saturday

Fitzgerald River National Park

Aesthetic dimensions of bushfire

Sidney Long *Spirit of the bush fire* 1900

Tim Storrier *Towards innuendo of impermanence* 1981

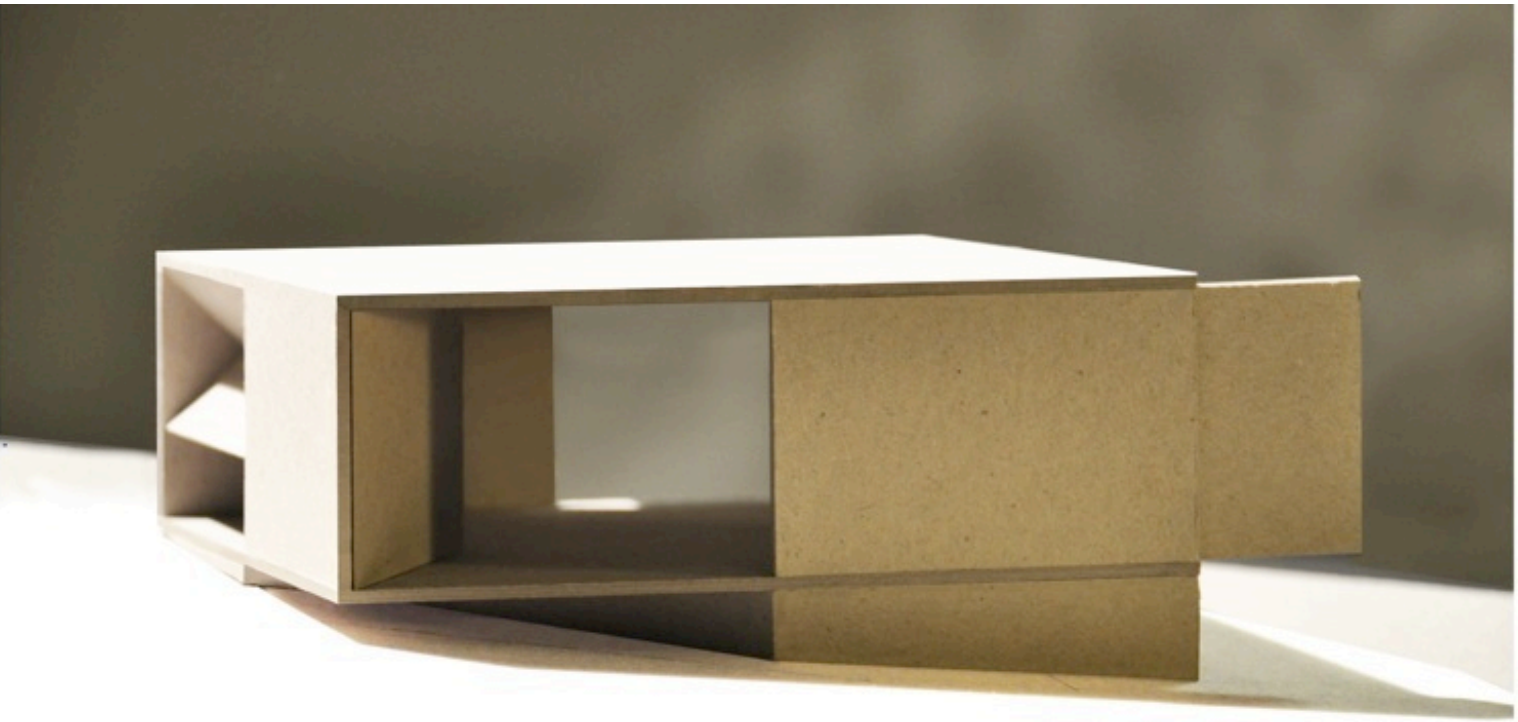
Richard Woldendorp *Helena Valley: aftermath of bush fire* c1986

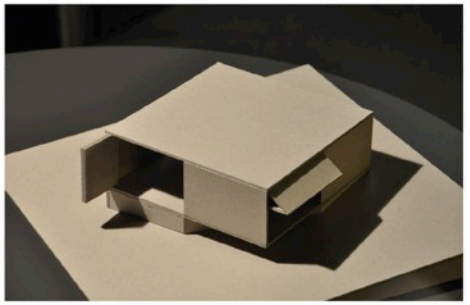
Howard Taylor *Stumps and ash*1951

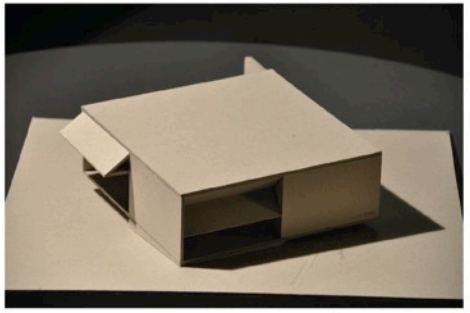
Howard Taylor *The black stump* 1975

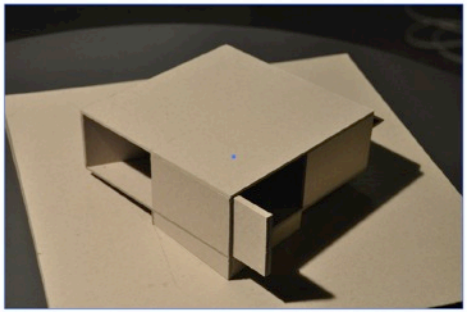

lightsite
Celebrating and Protecting Kwongkan Shrubland
QUT


QUT









Camera Botanica 2

Bushfire Responsive Architecture BALFZ **Flame Zone**

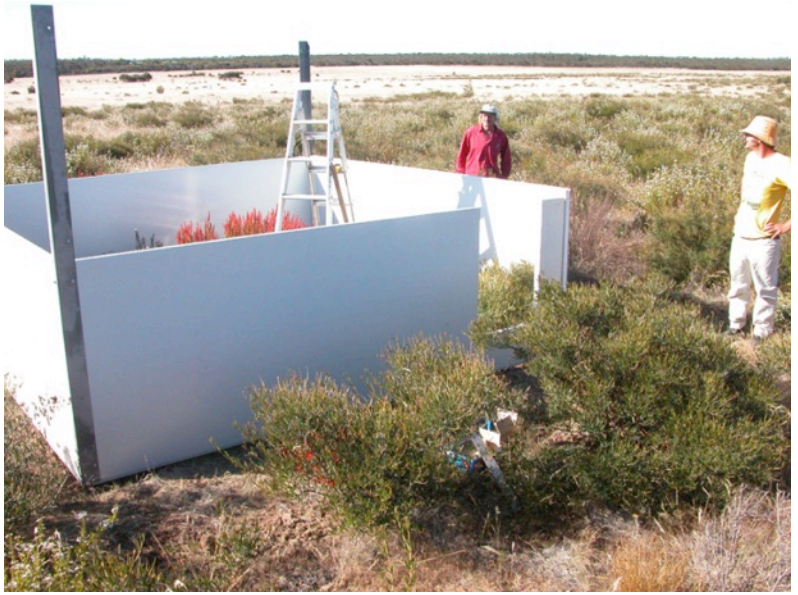
Lightsite 2006

Perth International Arts Festival

Australian Government

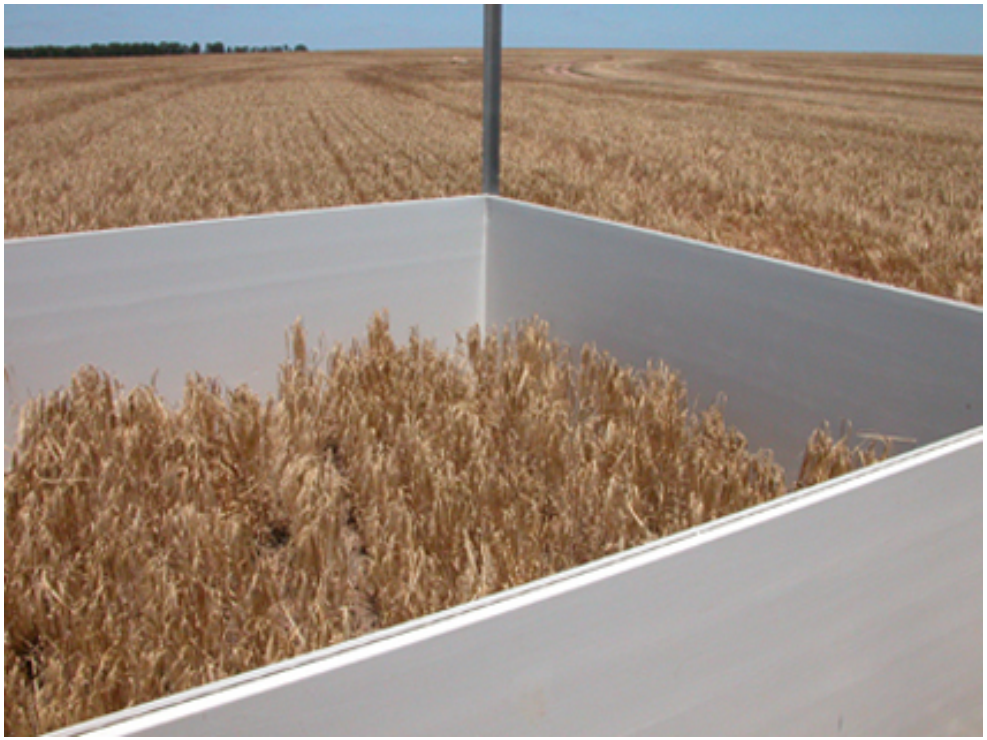
Regional Arts Fund

Collapsible camera obscura



Floorless - erected over vegetation


JERRAMUNGUP



‘COONAWARRA’ AT GAIRDNER

The Light of Gairdner (2006)

‘CONTENT TOO’ AT POINT HENRY

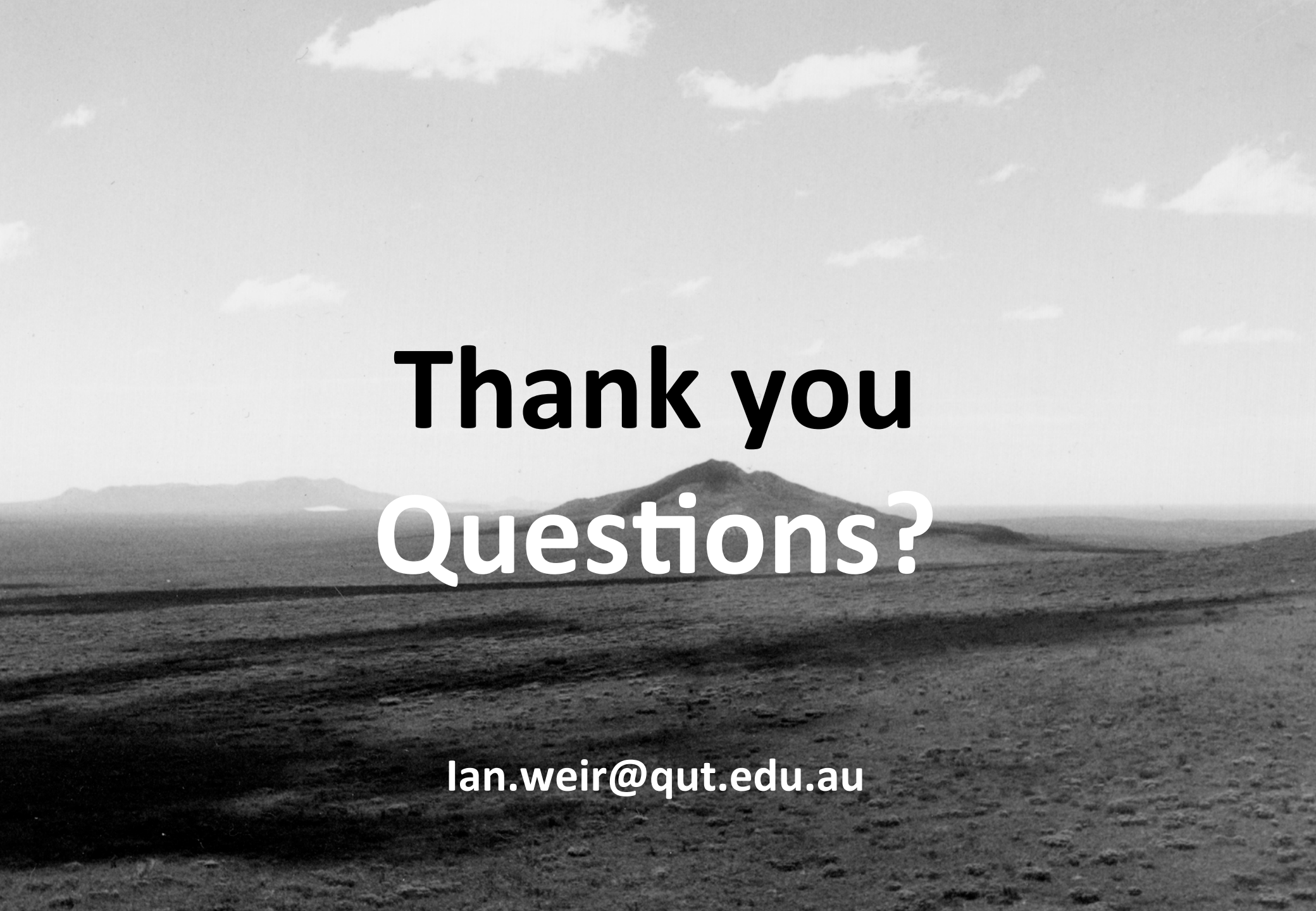
Barbara on Content Too (2005)


QUT

Reconciling bushfire safety and biodiversity conservation with daily life


This?


Or world’s best practice?


Thank you
Questions?
Ian.weir@qut.edu.au